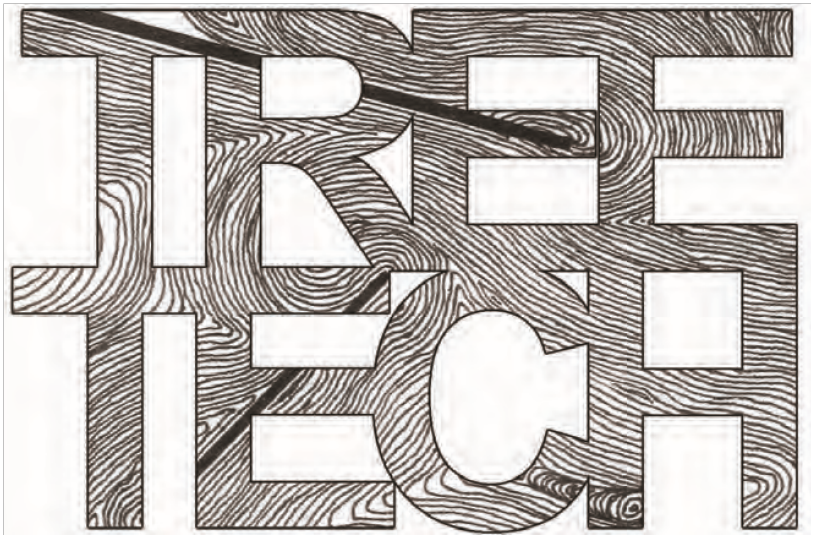

50 Lessons for Humanity

Written and illustrated by Umair Zia

Foreword by Roxanna Shohadaee

Copyright © 2022 Ümair Zia

All rights reserved. No part of this book may be used or reproduced in any manner whatsoever without written permission from the publisher, except in the case of brief quotations embodied in critical articles or reviews. For information, contact books@notacult.media.

Zia, Ümair

Print ISBN: 978-1-945649-50-9

Edited by Rhiannon McGavin
Cover design by Ümair Zia
Proofread by Daniel Lisi

Not a Cult
Los Angeles, CA

To Má Jee,

Mashal, the love of my life,

my teachers, Dr. Arfa Syeda, Dr. Murtaza Jafri,
Dr. Faisal Sajjad, late Architect Arfan Ghani,
and late Dr. Ghullam Abbas

To National College of Arts, Lahore where I learned from and
where I teach,

To the first cohort of the Design Science Decade at the
Buckminster Fuller Institute.

To the wisdom of the trees.

Foreword

• Invitation from a Tree •
A non-fiction personal experience
from Roxanna Shohadaee

Often in our lives there come moments, particular experiences that we are able to look back to as turning points which guided us towards a specific series of paths. Though sacred to many and unique to each individual, those stories aren't too often told.

I am honored to share with you a turning point in my life that came to me via an intervention from a tree. Now perhaps this experience could have happened in another moment across the sands of my life — alas, the saying "when the student is ready, the teacher will appear" comes to mind.

During the 2008 summer of my twentieth year on this planet in this human incarnation, on a warm Sunday in Rothbury, Michigan I awoke to the dew dripping on my face that had been collecting on the camping tent. I gazed left to find myself laying next to my sister. As I checked the time, it told me that we'd only fallen asleep 4 hours ago

after seeing the most beautiful joyous sunrise together. I realized that we were but minutes from missing the start of an incredible musical duo, a Mexican metal band turned classical guitarists who had been an anchor point for our journey to the music festival that was being held there. I woke her and as I told her the time she rolled to her side in exhaustion. As she nestled back to sleep she whispered one word.

"Run."

Sprinting out of the wet tent through the grass, I raced over two miles until I was front and center - dancing and smiling alongside thousands of other bodies, beaming in the sunshine to the oh so familiar passionate duet. As the final notes rang through the air and my cup of joy runneth over I slowly meandered out of the crowd and back into the forest from which I had emerged. After some time walking alone I happened upon a beautiful tree, with a lower branch so perfect for climbing I was quite surprised to find it empty. I climbed smoothly up their branches until I was comfortably positioned on a perch, nested holding their trunk in my hands.

What happened next has never left my memory, for it dramatically shaped the course of the rest of my life. As I stood, tucked within the trees branches I gazed at where my hand held the bark and noticed the bark moving, expanding. Lifting but a few fingers I realized that the

bark had raised to meet my hand, and beneath my fingers the bark had indented, leaving the exact shape of my hand in the bark. In trust and curiosity I gently laid my fingers down into the crevices once more, and at once my vision to the external world was replaced with an inner vision that took me into and through the center membranes of the tree's trunk.

Down I went, seeing the roots of this tree, then the roots of all the other trees around it connecting through a mycelial network of connection and communication linking them all together. Down my vision went until I was deep in the darkness of earth's belly and there, through the tree, into the earth — mama Gaia, showed me her pain. I saw at once scene after scene of forests being clear cut, biodiversity being lost, factory runoff polluting waters and strangling the life from creatures within it, resource extraction all across the planet poisoning the groundwater, the air, all of life around it — scene after scene through fragments of embodiment I felt the wetness of the tears streaming down my cheeks. In my body I felt her pain, the earth's visceral ache of love and confusion. And then, in the depths of that deep embodied grief the vision… changed.

Before me, all pastel purples and pinks, an eternal sunrise and sunset twilight — accompanied by a deep softness and warmth, a voice rang clear.

"You can help."

At once my vision reversed in fast forward up up up through the roots and up the trunk until my eyes opened. Before my eyes my hand laid grasping the tree trunk that held me back, and as I took a breath back into the present moment before me the bark of the tree lowered so the trunk once again was smooth and no handprint remained — and leaning against the cradle of the tree I sank down into her branches and wept. I wept in silence until I had no more tears, and it was as if no one saw me though hundreds of people passed by.

I sat there and steadily metabolized the vision I experienced through the tree, until I finally checked the time and 5 hours had passed. I saw within me the clarity of purpose this tree had gifted me - to dedicate my life with every ounce and fiber of my being to help support a future where all may thrive at the expense of none by making the invisible visible and encouraging the innate ability in all life to be a net positive with nature. With an aching grateful heart, I gingerly leaned my forehead against their bark, thanked them and stepped out of their branches.

"If the success or failure of this planet and of human beings depended on how I am and what I do…

How will I be? What will I do?"

R. Buckminster Fuller

Introduction

There is a small ancient tribe hidden deeply in the Himalayan range of Pakistan. The people of this tribe wear rugged black robes that are heavily laden with beads and stones of florescent colors. The tribesmen and the tribeswomen live long. They speak in a tongue unlike any other spoken in the world. Their timber architecture is profoundly complex as the parasitical configurations of their dwellings appear to have no host. The people of this tribe are polite and congenial to the foreign guests. There is no concept of knocking-on-the door for instance. They drink wine, sing songs, and dance together. The humans of this tribe are not insecure about losing their identity with the growing number of visitors. However, they excommunicate any member of their community who changes his or her religion. Their religion is uncompromising. They have many gods all of whom are- in one way or another- associated with the forms and processes of nature. On the eve of winter solstice, they pray to the gods to keep the trajectory of the sun from drowning below horizon. If the path of the sun dropped any lower, their existence would be at risk. Their prayers are heard and the path of the sun starts rising again from the next day. Upon arrival of the summer solstice, they celebrate and dance to the completion of the gods' blessing upon them. The

tribe is called *Kalash* and its people are known as *Kalasha* or the *Kafirs* of the *Kalash* valley.

Historians have traced back Kalasha settlement to at least as old as Aryans (1500 BCE)[1]. Although UNESCO has organized several studies to document the Kalasha culture- and a few programs to preserve it, perhaps the most detailed and thorough account remains to be George Scott Robertson's century-old publication *Kafiristan*[2].

The 50 lessons presented in this book borrow much from my conversations with the Kalasha elders. I went to the valley in 2001 to document the architecture of the village. But as it often happens with journeys of serendipitous nature, over there I met a 50-year-old *Tok*[3]. The Tok tree and I got acquainted on the same night Kalasha performed their famous *Chaomous* dance around it. The humans, women and children of the tribe wore their deep cosmic dresses and made an orbit around the tree. They danced joyfully round and round the tree under the magically embroidered purple night. There was neither a song nor music, only occasional claps synchronized

---

[1] Ali, Dr. M. K. "Kalash Culture." Ancient History Encyclopedia. Last modified December 21, 2011. https://www.ancient.eu/Kalasha/.

[2] Please read J. S. Robertson's, '*Kafiristan*', and '*Kafiristan and its People*' by Royal Anthropological Institute of Great Britain and Ireland (1894), and The Royal Geographical Society (1898) respectively.

[3] An indigenous and old peach tree of Kalash valley

clumsily with the thumps of the steps. A small boy fetched me to the ring and made me join the dance. At first, I copied their steps consciously but when no one gave heed to how horribly I danced, I decided to close my eyes and let myself follow the slow rhythm of the circling flow. Before long, I was in a sort of a trance. I felt being held by the invisible branches of the tree- that would not let me or anyone else in the chain break off from the ring. We flowed together naturally, eternally, orbiting around the old wise tree.

After a few days of self-conscious-architectural-documentation later, I dropped the pretentious act altogether. I sat down with an elderly Kalasha one day and inquired about the tree. The elderly Kalasha chuckled amiably and took me to the tree nodding and chortling happily all the way. He made me sit near the roots of the tree and then left himself. I sat there for some time observing my surroundings and half-expecting some sort of an awakening but it never came.

Through the last decade however, I kept noting down those curious facts and propositions that came to me whenever I thought of that tree. Here I have filtered out those facts that concerned the Tok tree only and have presented those 50 lessons that apply to all trees generally. By all trees, I mean all those botanical beings that have roots, leaves and some structural components in between. If people were asked to draw a tree out of their imagination, all of them would

make different drawings of a tree. But they would not draw a car or a shoe. This suggests that there is an abstract- an essence- of all trees in our minds. The word tree in the title refers to that essence of a tree. Another important concept in the title is the word *lesson*. Lessons can be concluded either from reliable results (like in science) or from the principle of sufficient reason[4] (as in philosophy). In order to learn a lesson from a tree, we must understand the reason behind the given attribute of a tree. We can learn valuable life lessons from the technology of the trees with unwavering clarity and confidence, by observing the trees through complexity[5] perspective.

Till late 1950's we thought that human brain worked like a CPU of a computer system- centrally managing all the complex processes. With the developments in complexity sciences however, that perspective has evolved. Today we know that even an immune system alone functions like a complex adaptive system that does not require linear instructions from the brain. Furthermore, the components of each biological system such as the skin of a skeletal system perform multiple tasks at the same time through continuous molecular-level reorganizations. Holistically, today, an accurate static diagram of a human body is perhaps impossible to conceive. A key outcome of the

---

[4] The principle states that everything must have a reason or a cause.

[5] Neil, *Simply Complexity: A Clear Guide to Complexity Theory*, 32, 44-46.

study of living systems from a complexity perspective is that 'as complexity increases, lesser and lesser parts of the system are able to perform more and more functions'[6]. As a result, it is about the different *ways* in which the parts of a system interact with each other instead of the parts themselves, that determines the level of complexity of a system. From this scientific evidence we can form a general premise that if a system requires more dedicated parts (or organs) to perform specific functions then the system is less complex. Conversely, if a system requires minimum dedicated parts or organs to perform multiple functions, it is more complex. This premise is an underlying guide for each of the 50 lessons in this book. After a rational comparison of the collective behavioral pattern of trees with the collective behavioral pattern of humans, we find that there are at least 50 lessons for entire humanity that can be learned from the technology of the trees.

For each lesson in this book, readers are treated visually with an illustration of the same. These illustrations are renditions of the invisible essentials of the trees. Please read and enjoy- and if you are holding this book during the second[7] design science decade (2020 to

---

[6] Gell-mann, *Quark And The Jaguar: Adventures in the Simple and the Complex*, 128. Also see Sir Richard Buckminster Fuller's demonstrations of a trimtab.

[7] Buckminster Fuller's first design science decade lasted from 1965 to 1975. For information on the second design science decade, please visit www.bfi.org

2030) that is inspired by Sir Richard Buckminster Fuller's vision for the future of technology that works for all life, then do consider becoming a trim tab (just like a tree) yourself.

50 Lessons for Humanity

Non-hierarchical education is possible

Educational system of humans is largely based on student-teacher mode of learning. By the time most students start contributing back to their society, they have already lived a major part of their lives. A tree on the other hand maintains- from the germination of its seed to full spread of its branches- a continuous, non-hierarchical exchange of information with its context.

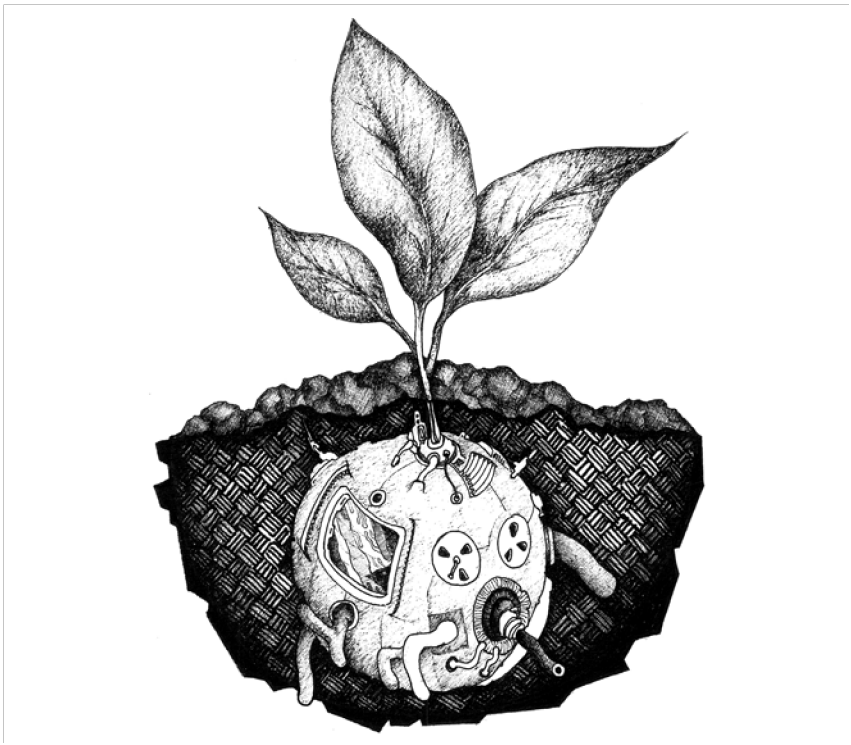

Fig 1. Germinator.of consciousness.

Gender is a verb

Throughout history, humanity has struggled with innumerable facets of gender discrimination. Gender is rather a fluid[8] concept for the trees- we call it blossoming. Successful way of the trees teaches us that a world that has no concept of fixed gender can exist.

[8] Despite detailed categorization of trees by humans, trees cannot always be termed male or female. Usually, the blossoming of the flowers is taken as a sign for the beginning of a reproductive maturity.

Fig 2. Gendering of a tree.

Connection deepens with fewer words

Clarity of thought is inversely proportional to the number of words required for communication. Despite a towering pride of humans in their power of communication, extensive use of words- like lengthy codes in computation- is an indication of imperfection. Animals and birds use fewer words to communicate than humans. And trees communicate[9] without the need of words. A socially connected world must clean its byproduct of word-pollution. Humanity must listen to the silence of the trees.

[9] Wohlleben, *The Hidden Life of Trees: The International Bestseller – What They Feel, How They Communicate*, 31.

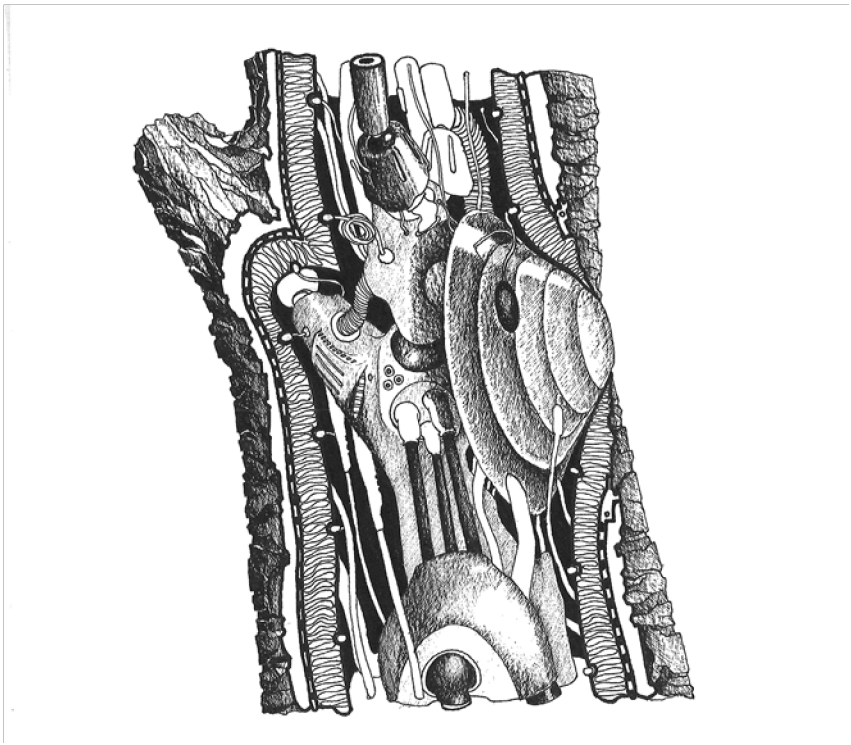

Fig 3. Word-energy recycler of a tree.

Emotions are tamable through knowledge of things

Emotions of human beings are the manifestation of the knowledge they possess. Humans' love or hatred towards something changes instantaneously when new knowledge is revealed to them about that thing. A tremendously volatile state of human emotions suggests that they know very little about things. On the other hand, trees reveal no emotions at all. It is only logical to deduce that knowledge of the trees is grand.

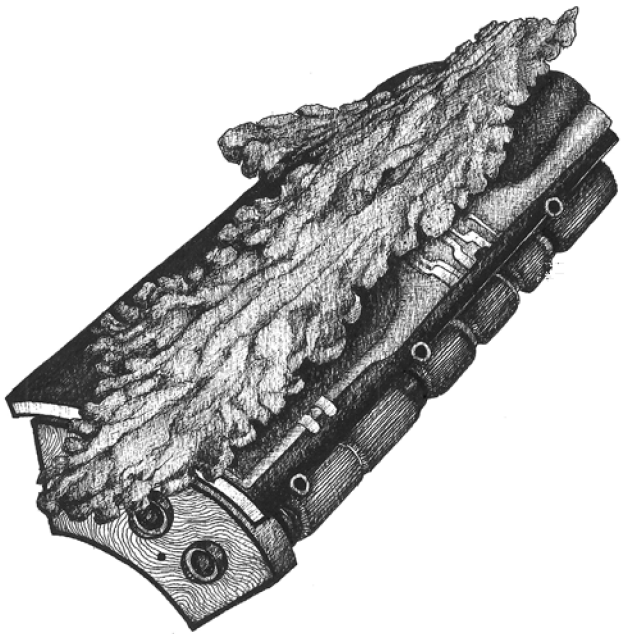

Fig 4. Emotion processor under the bark.

A love-letter does not have a return stamp

Wisdom is rootless without love. Humans have forgotten the craft of writing letters; their love is often mixed with reason and they are almost always eager to know the response. Trees put a part of themselves in their love-letters. Trees either send those letters flying or have them transported to their lovers. Love of the trees is unconditional as they write to mountains, land, water, and wind.

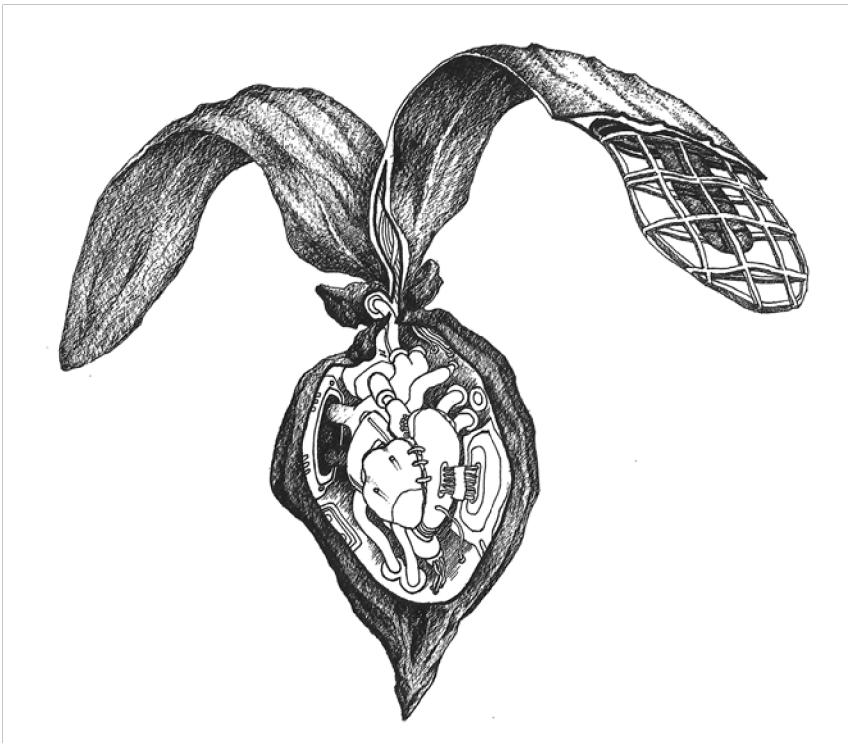

Fig 5. Heart of a flying seed.

To want more truly, is to have less

Human beings want more power, more gadgets, more land, more everything to themselves. This drive is a key force in making a world that works for the entire humanity. Trends like cross-programming in architecture, or parsimonious design in the software industry prove that human beings are vastly capable of achieving more with less. But their lessening creates room for still further more. And hence a productive effort becomes exponentially counter-productive. Trees make do with less too- and they maximize the output as well. But the only difference is that trees direct their magnanimous synergistic benefits out to the surrounding context whereas human beings acquire such benefits for themselves.

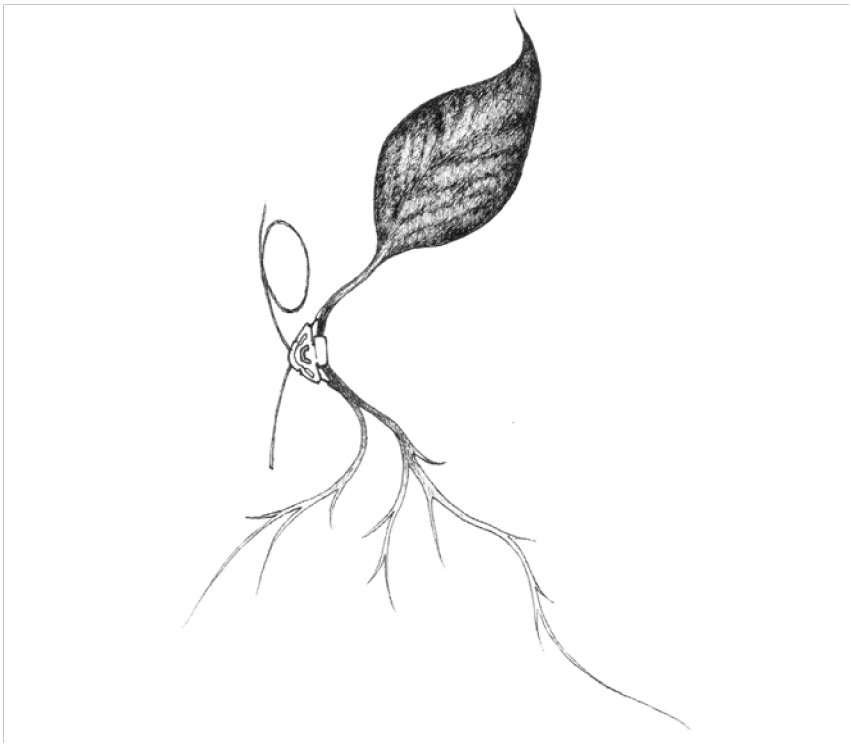

Fig 6. Thread that connects earth. air, water and sun.

Time expands when motion contracts

For human beings, the experience of timelessness is an attribute of all good things; good music, good architecture and good literature. Humans desire eternity in their happiness too. But their lives are transient and far too vulnerable to change when compared to the lives of the trees. As the change or the movement of the trees approach zero, the time in which they live starts expanding. Trees experience timelessness amidst change.

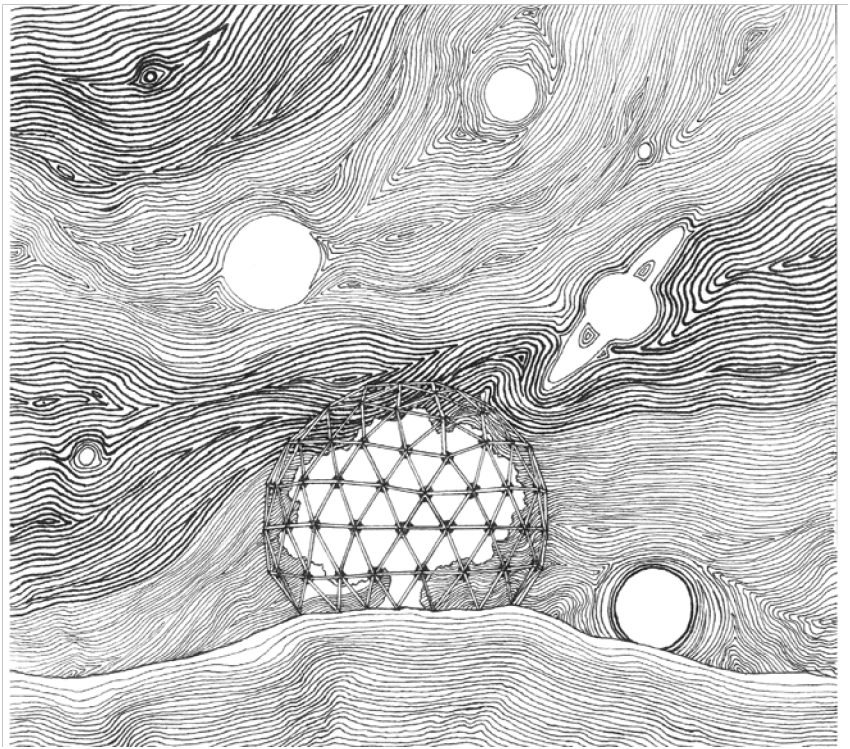

Fig 7. A tree marking the contraction point as its surroundings expand.

The living matters the most

Human beings long to live larger than life. They have philosophized immortality in a number of ways. Some of them want their names to live on while others, their deeds. Humans make sculptures and keep the names and the deeds of their past fellow beings alive, in the hope to live on like them. But these hopes and aspirations are as unfounded as the names of the human beings themselves. All humans dispose of the same way. But trees on the other hand, remain strong and present long after they are dead. In this case, instead of trying to become like trees, human beings should embrace their own construct and respect Life above all else.

Fig 8. Sparrow on a snag.

Individuality is an outcome of a cultural process

Human beings like to express their individuality and often take pride in their unique ways. The originality of both human beings and trees is however an outcome of complex contextual processes. Whereas humans are tempted to boast off their uniqueness, trees are humbled by it. The form and growth of the trees are visually influenced by their surroundings.

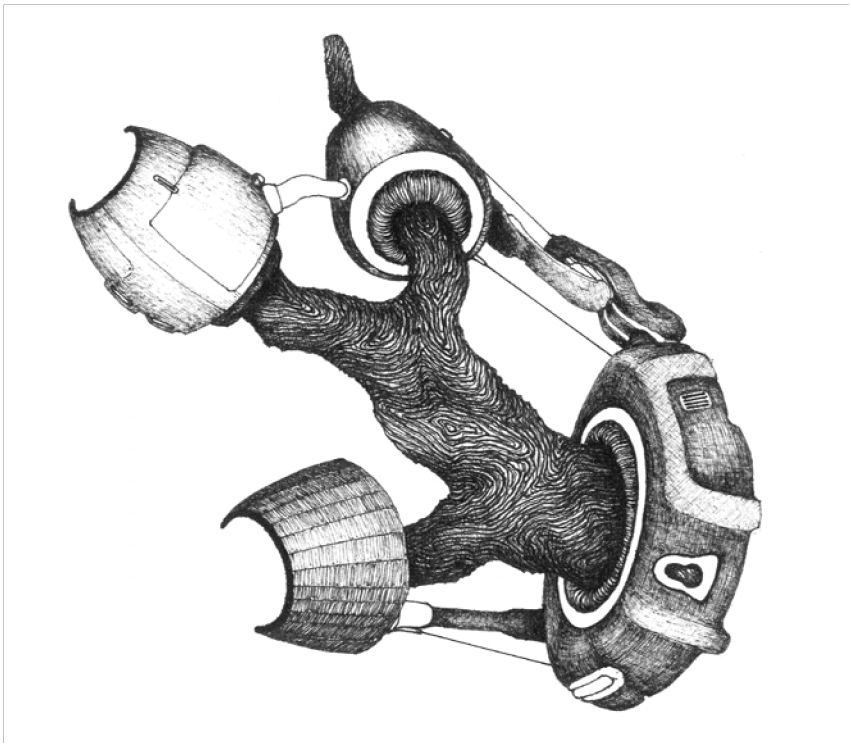

Fig 9. Surrounding-sensors governing the growth and form of a branch.

The capacity to create synergy[10] is the capacity to create a scientific metaphor

Ideas of things can be understood by understanding the physical construct of the things which embody them[11]. Humans conceive metaphors because their brains have exceedingly complex physical constructs. Those humans who draw unfamiliar connections between familiar objects are considered wise by other humans. And those who can make the meaning of an object fluid are considered still wiser. All human-made metaphors are an outcome of the physical construct of their brains. So what are the metaphors of the trees and how are they different from those of humans?

[10] Fuller and Applewhite, *Synergetics: Explorations in the Geometry of Thinking*, 14.

[11] From Louis Kahn's famous saying that, 'Even a brick wants to become an arch'.

The physical construct of the trees is so evolved that they do not need dedicated organs for the purpose of thinking. Trees grow holistically and their thoughts are a synergistic outcome of their design. The proof of trees' superiority of metaphors over those of humans' is two-fold. Firstly, the physical construct of almost all human beings is limited by the factors of form such as the number of their limbs. Each tree on the other hand, grows its branches in vastly varying numbers and forms. Trees' physical construct is so abstract that they can themselves be mistaken as metaphors for other things. Secondly, human beings need something meaningful at first in order to draw an abstraction from it. Humans cannot conceive a meaningful abstraction from an abstraction. But since the physical construct of the trees borders abstraction itself, the metaphors which they create cannot be perceived by humans.

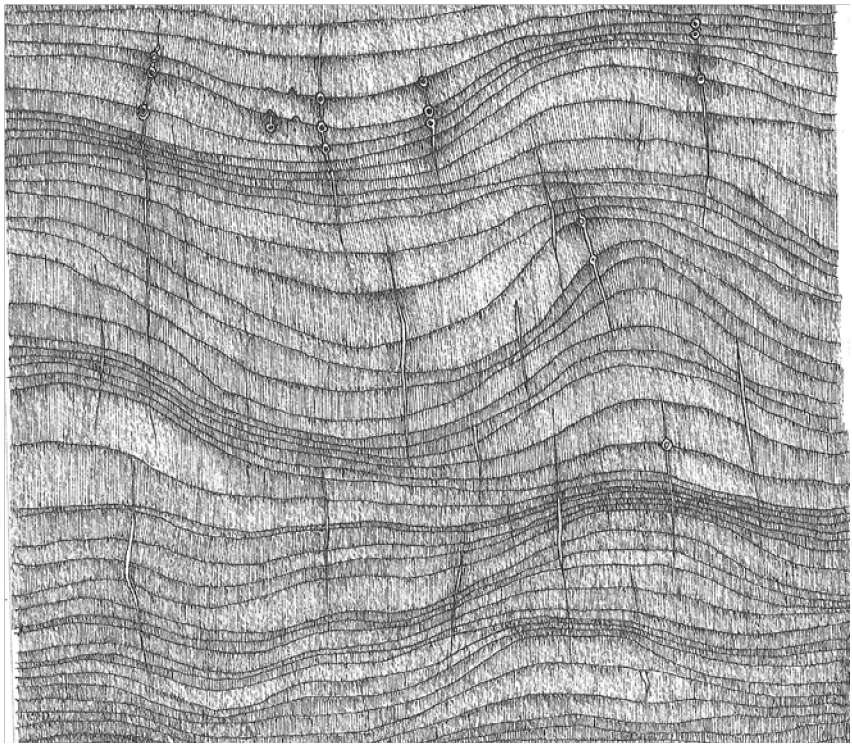

Fig 10. Countless layers of cambium.

Humanity like treeanity can be uncompromising

If the only way to save mankind was to take the life of an innocent man, the world of the humans would be divided. It is because humans cannot distinguish between humans and humanity at all times. Trees on the other hand, never hesitate to save treeanity over trees. Trees neither judge their dependents nor rely on them and the wisdom of the trees brings them an unwavering clarity and strength. Sometimes, the trees break under the forces of nature but they never stop bearing the load of their dependents. Unlike humanity, treeanity encompasses all nature.

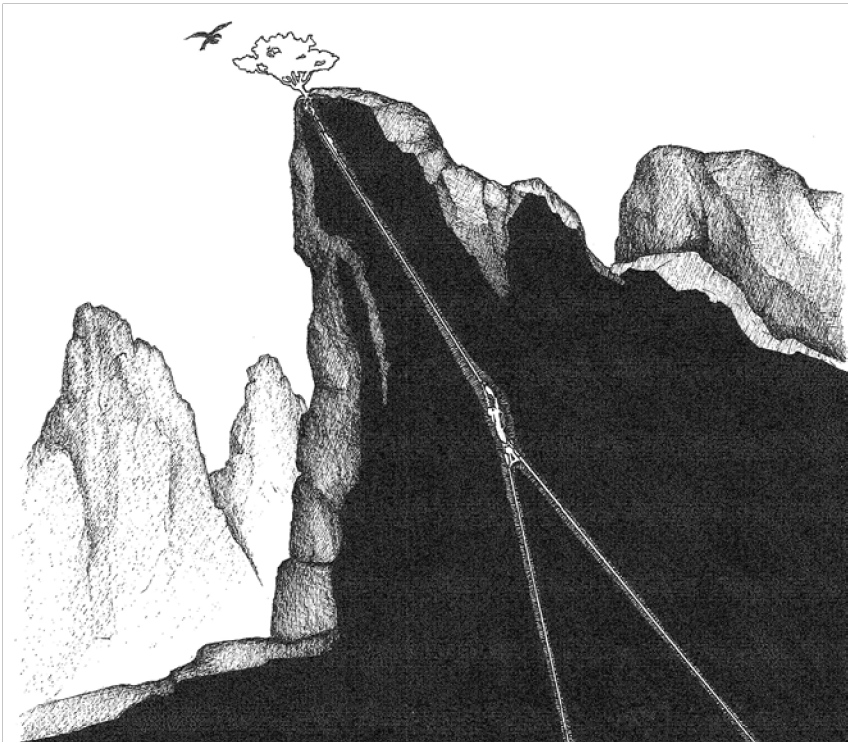

Fig. 11 A tree on the top of the mountain.

Inclusivity is paramount

Diversity is an option for humankind. Humans define their identities in comparison to their fellow beings. There are countries, traditions, races, and religions. Trees on the other hand, do not entertain any possibility for the *othering* of species and ecosystems. Trees are all-inclusive and ever-inviting.

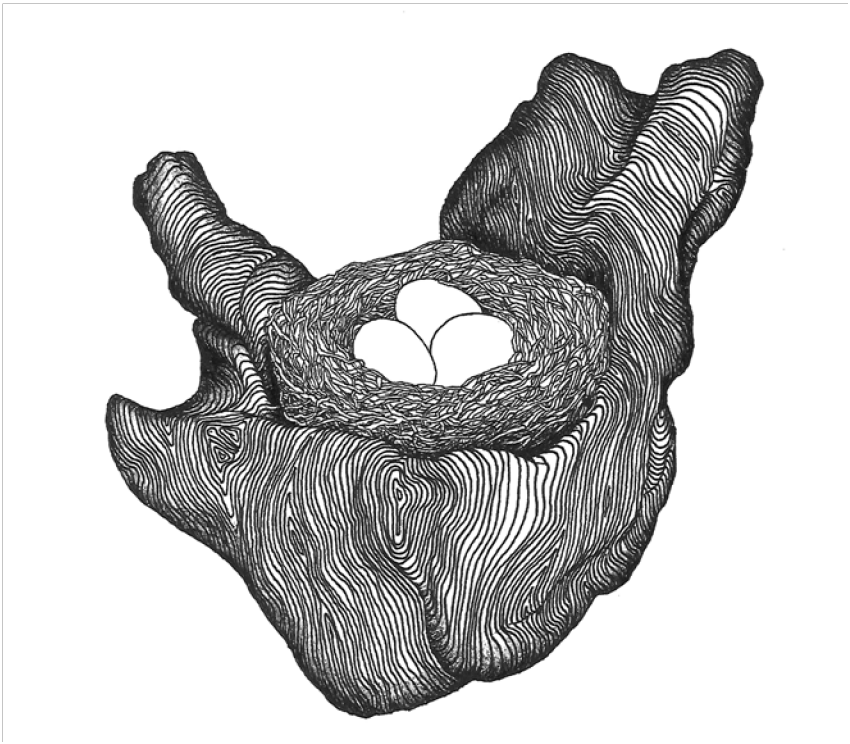

Fig. 12. Conditions conducive to life.

A part grows in a straight line, a system grows in a curve

A reason for the increasing divides in humanity is a general principle that when a group of parts evolves independently from its neighboring groups, its evolution is exponential. Each part of that evolving group borrows from and feeds into another part of the same group, and the group as a whole advances rapidly. As a result, those groups that have not evolved as such find themselves lagging behind with the same rate. Trees make sure that all groups in their system evolve together. That is why tree-systems are the embodiment of infinite strength and possibility.

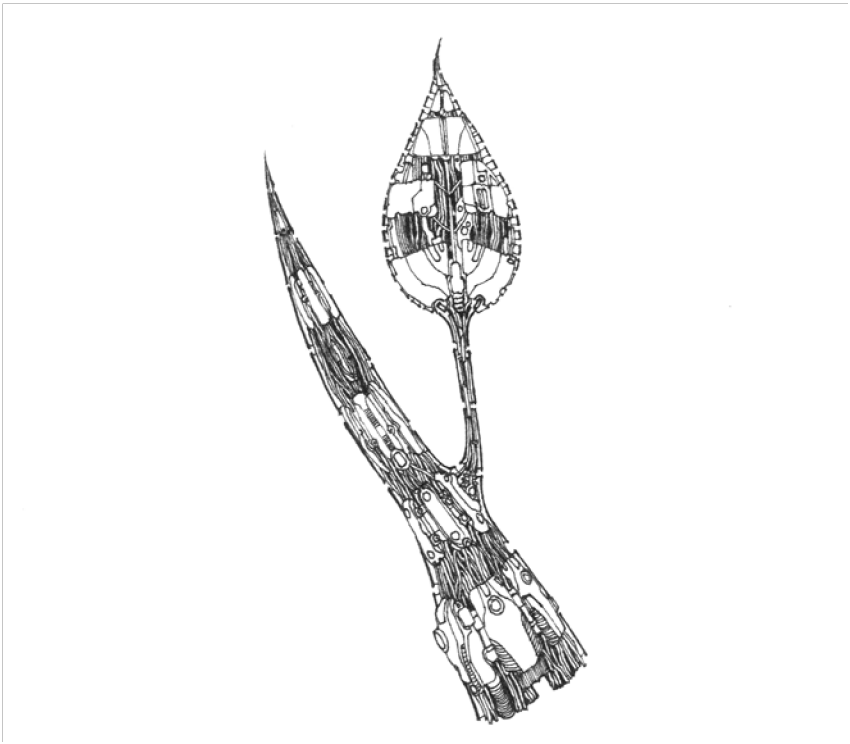

Fig. 13. The tips of the branch and the leaf.

Nature is trying to serve humanity

Humanity is blocking out the abundance of energy in nature by remaining fixated with self-created concepts of wealth and progress. Humanity fights over natural resources because it is convinced of their scarcity. Consequently, when human beings find those resources they take more than they need. Like trees, humanity could attempt to embrace the abundance of energy in nature. And while remaining aware of the abundance of energy, humanity could advance its technology to take as little from the abundance as possible- just like the trees.

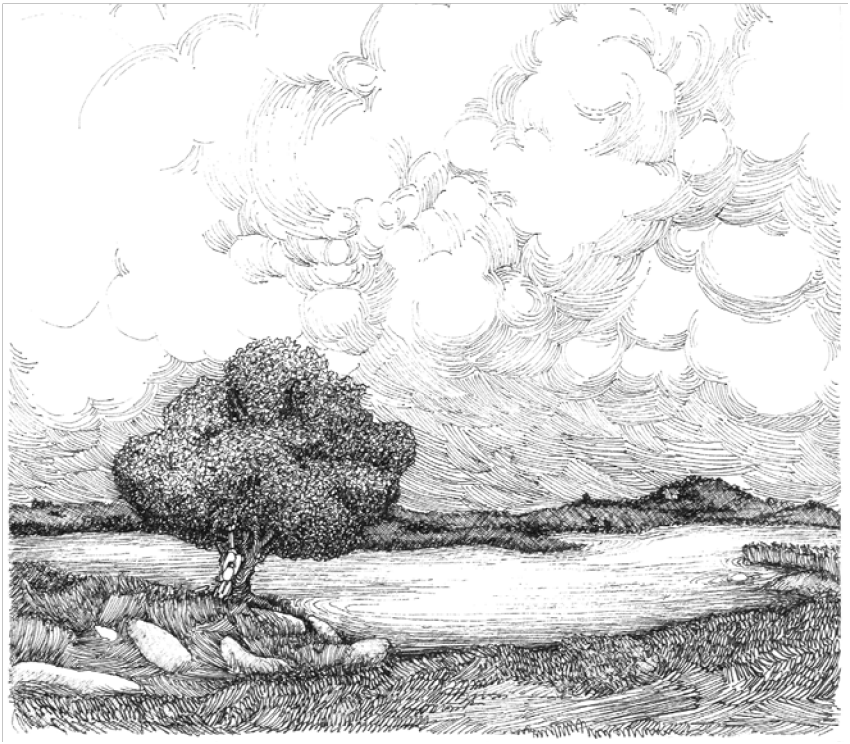

Fig. 14. Nature nurturing a tree.

Fight is never an option

Fight- as deplorable as it is- is the last option for humanity in resolving a conflict. Can we imagine a world in which killing is not an option for any country involved in any dispute? Trees help us imagine a system of co-existence in which war is not an option. Trees choose not to fight even if their very survival is at risk[12].

[12] We have already assumed a premise in the Introduction of this book that trees are intelligent beings. The intellectual capacity of the trees is so deeply evolved that- like other organisms- they do not require a dedicated organ for thinking purposes either. Unlike other more recent life forms in natural history, trees act on their wisdom of not fighting.

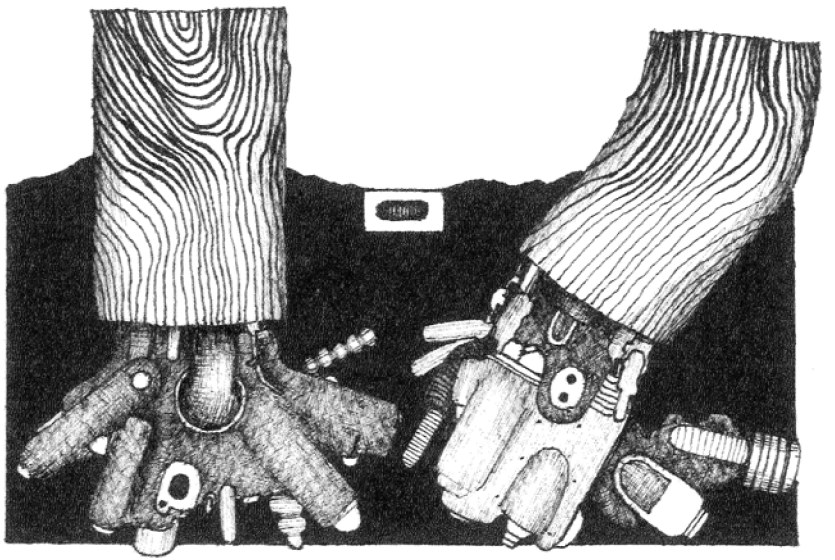

Fig. 15. A tree (right) changing its own course to protect the neighboring tree.

All changes are adaptable

Humanity resists change because the learning curve of humankind rises and falls with the passing of time. The knowledge that most humans acquire through learning or experience becomes their safety net with age[13]. It takes most human beings several years to change their belief systems and most humans do not question themselves all their lives. Trees retain nothing that would obstruct their learning, and they remain ever-adaptable to change from start till end.

[13] Idea inspired from the philosophical approach of Friedrich Nietzsche.

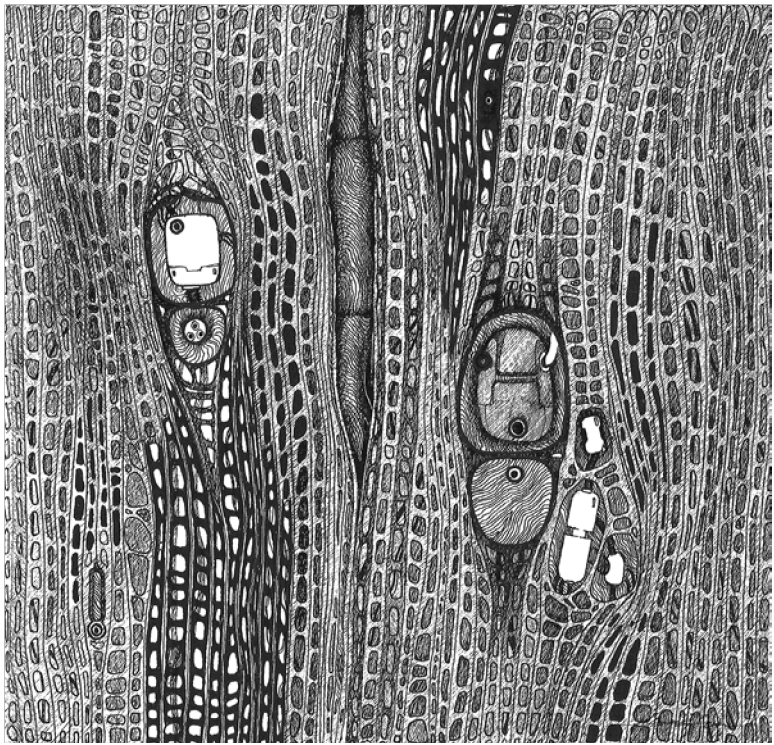

Fig. 16. Nanoscale sensors found in the medullary rays of the wood.

A part can remain integral and connected at the same

As humanity begins to embrace the ideas of complexity as predominant perspectives to life and reality, it is imperative to understand and respect the sovereignty and the integrity of the local parts of a larger system. Trees teach us that it is possible that parts remain sovereign and share the goal of the system at the same time. Trees- as physical manifestations of complex geometries- also suggest that humankind must rediscover the nature of the parts and the nature of the whole before rediscovering the relationship between them.

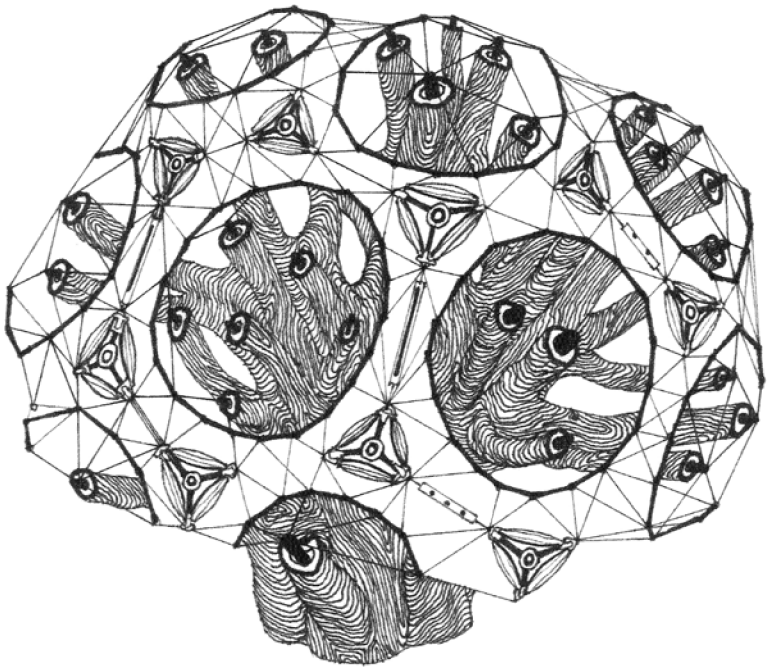

Fig. 17. Integrity-regulator of a tree.

All things are trying to preserve their integrity

The way of the trees teach us that a most predominant illusion of humanity is its sense of control over other life forms. All life forms are trying to preserve themselves- and trees inspire humanity to respect it. Most life forms including human beings are attracted to the trees because trees understand that all life forms must be allowed to find their own habitat. Trees teach us that humanity must perceive reality in which all life forms are trying to preserve their existence. Even trees themselves find those places where they wish to grow but most human beings do not perceive it. Zoos- no matter how animal-friendly are then against the potential or the desire of nature.

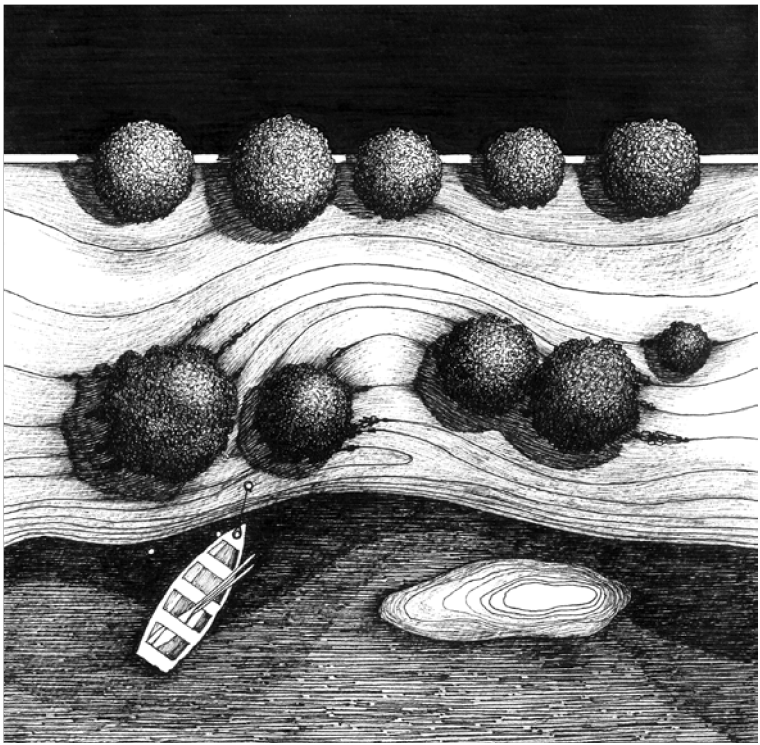

Fig. 18. Trees finding the edges where the river meets the soil, and the park meets the road.

Systems-thinking is a mind set

Human beings design systems like designing objects mostly. Only recently in human history, humans are talking about creating the different forms of enabling constraints [14] . Trees always create conditions that are conducive to other life forms and ecologies. Humanity has much to learn from trees on how to grow strange attractors for the benefit of the planet.

[14] A term invented by Dave Snowden

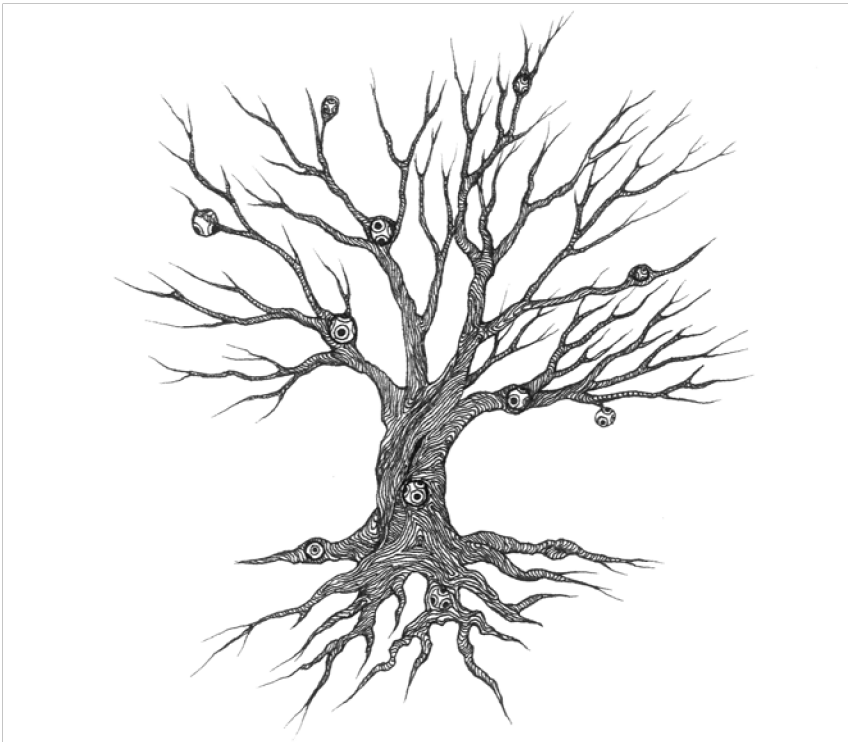

Fig 19. Ecological attractors of a tree.

System-level awareness is the key to fighting disease

Recently, humanity struggled to end a global pandemic. There are human groups and organizations working to increase the immunity of the humankind. But the governments of all countries hold themselves accountable for the disease in their own country only, and those countries which concern themselves with others usually grant others some aid. Trees- with their extraordinary defenses against disease- teach us that if humanity wishes to develop immunity against disease, it must work together through active political decision-making at a full global scale. In order for the aching parts (countries) to receive help with the rigor of the trees, work must be done to establish an unshakable trust at global scale.

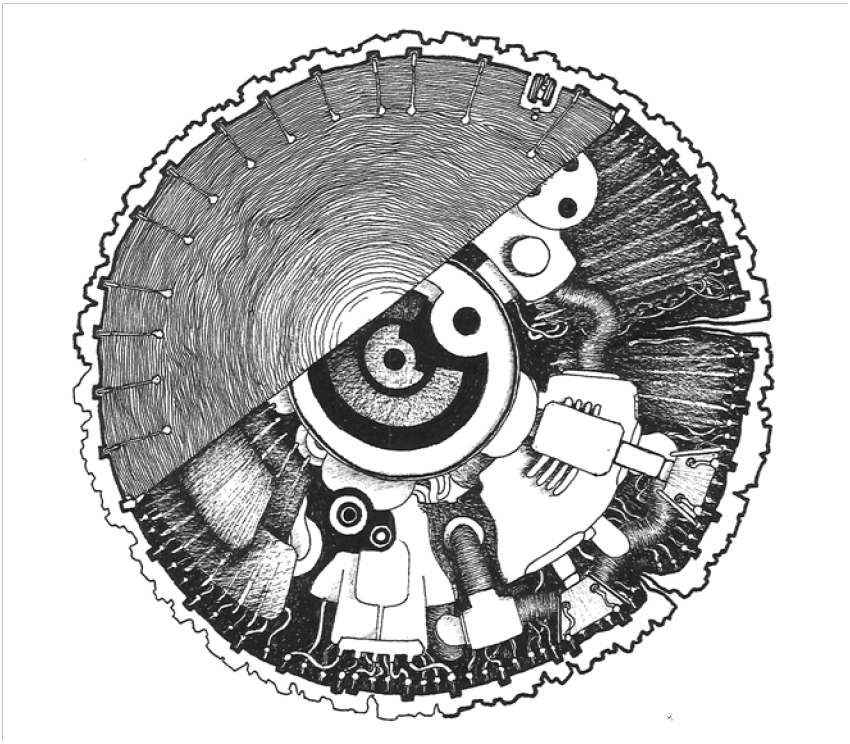

Fig. 20. Healthometer of a tree.

Happiness is a synergistic outcome of the harmony among things

The scale and the duration of happiness, is related to the nature of the thing which brings happiness. Trees are capable of bringing joy and happiness to humanity (and possibly to other life forms) in all ages and at all times. It is so because of the permanence and the endurance that are integral to the nature of the trees. If humanity concerns itself not only with temporary joy but with a lasting happiness then humanity has much to learn from the subtlety of the trees.

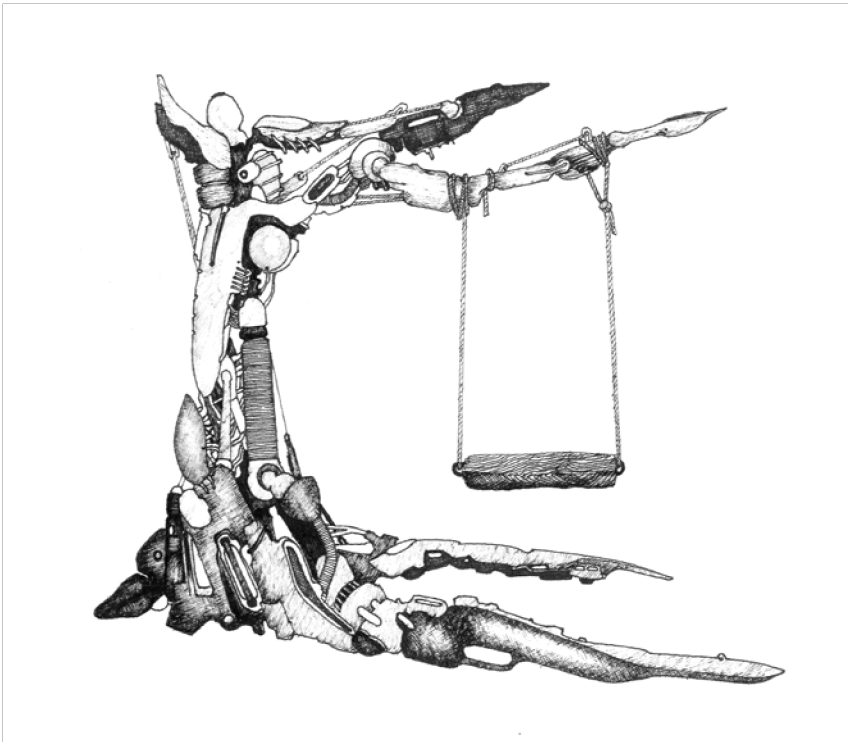

Fig 21. A swing on a tree.

A place is a plugged space

Memory is a key difference between space and place. Place-making requires elements of endurance around which the spatial activity can flow smoothly and perpetually. For human beings, trees are an example of place-making elements. Where most human beings work to build good spaces, trees have the presence and the wisdom to turn those spaces into a place.

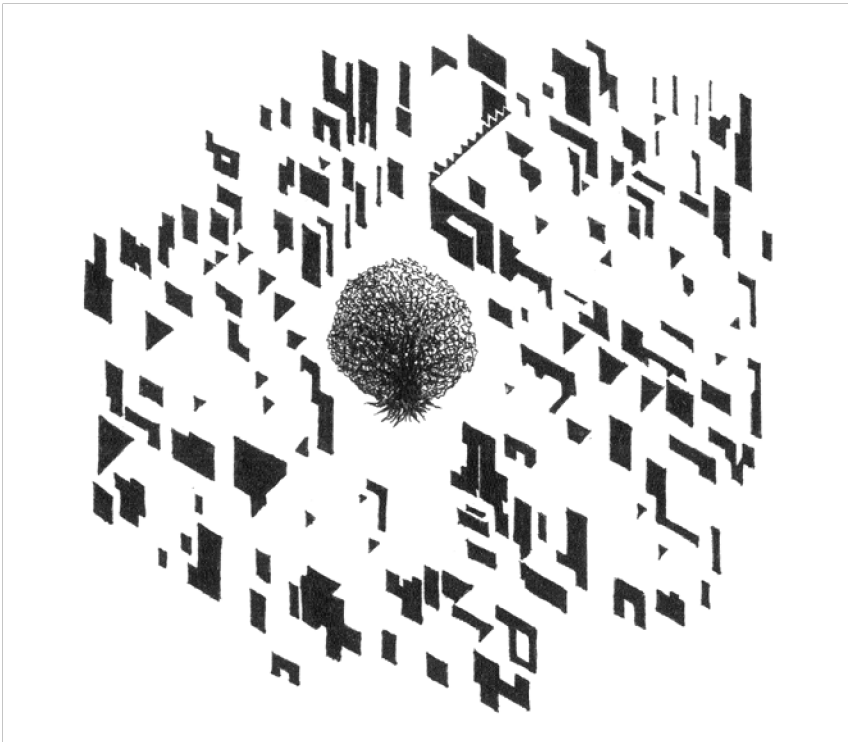

Fig 22. Tree is a place-plug.

Stress is the fiber of strength

Humanity is still largely fighting the forces of nature- or is ignoring them at all. Only recently in human history, Sir Richard Buckminster Fuller stressed upon *using* the forces of nature instead of fighting or ignoring them. Trees always use the forces of nature to their advantage including gravity, wind, water and solar radiation.

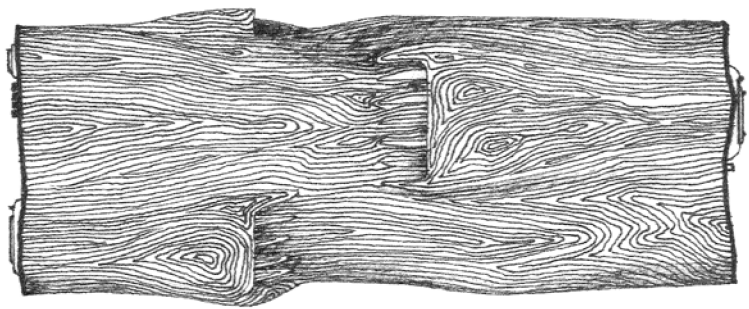

Fig 23. Air-intakes and wind-roots of a branch.

The weight of the void determines the capacity of a system

Social distancing during the 2020 pandemic reminded humanity once again that the distance between two parts of a system can be the distance between the life or death of those two parts. Proxemics is a study in architecture of how human beings group up together with respect to their built environment. Humanity has much to learn from the proxemics of the trees in a natural environment. One such behavior of trees is that their outermost branches maintain a certain distance from the branches of the neighboring trees[15].

[15] The phenomenon is called crown shyness

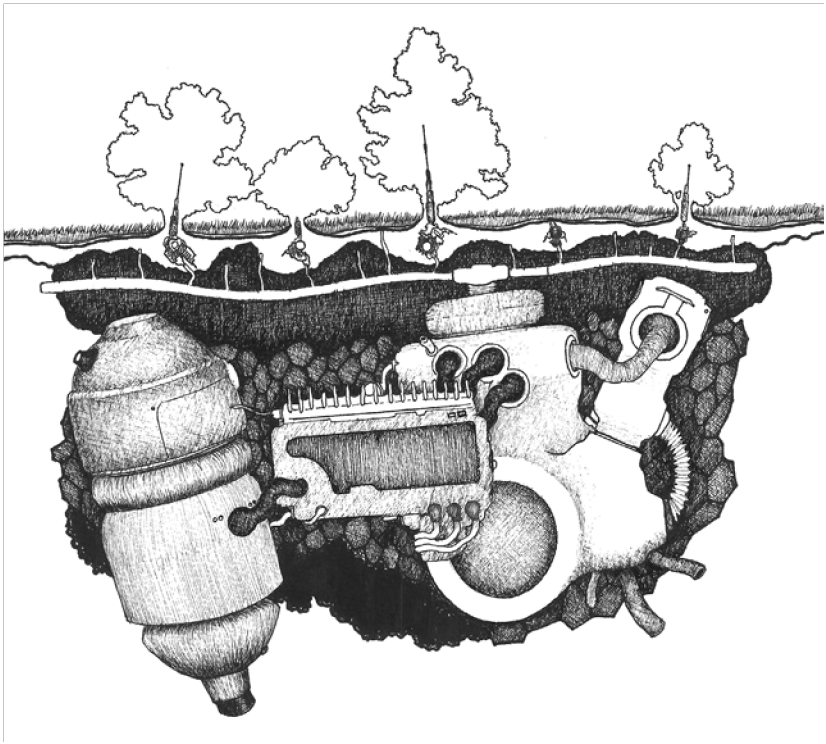

Fig 24. Forest proxemics.

An equal distribution of the resources to all parts of the system, advances the system

Human beings have always attempted to know themselves through knowing the natural world around them. Ideas like survival-of-the-fittest have influenced the minds and the identities of many human beings, particularly of those living in the cities. Where such propositions may describe the evolutionary process of some or most species, the ways of the trees are now being discovered diligently[16]. It is about time humanity started exploring the possibility of a new paradigm: survival-of-the-most-benevolent.

[16] Please see the rising trend of Google searches on the topics concerning the trees in last five years (2015-2020)

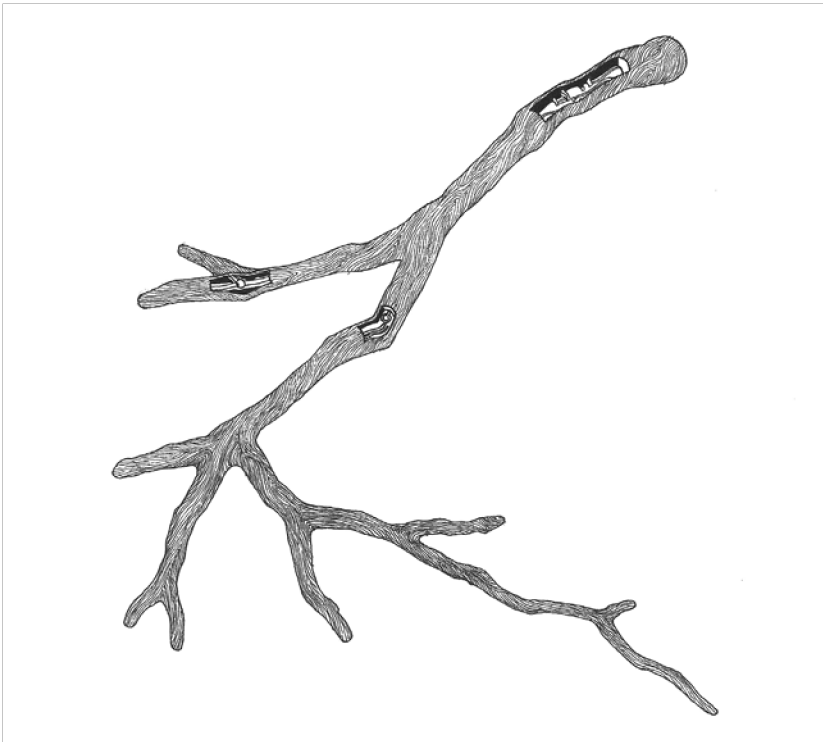

Fig 25. Resource-rings at different sections of a branch.

Farther the imagination flies, stronger the mind becomes

Trees give humanity the hope and the confidence in thinking bold and wild. Humanity is at the cusp of making dramatic changes to its core paradigms. With a wider adaptation of complexity perspective, the design of the new paradigm has become a pivotal factor of change. If the new paradigm lacks the capacity and the strength to support and nurture new ideas, the system could collapse under its own weight. Design science decades[17] render an excellent opportunity to accelerate such holistic change.

[17] The first design science decade started by Sir Richard Buckminster Fuller lasted from 1965 to 1975, and the second decade is from 2020 to 2030.

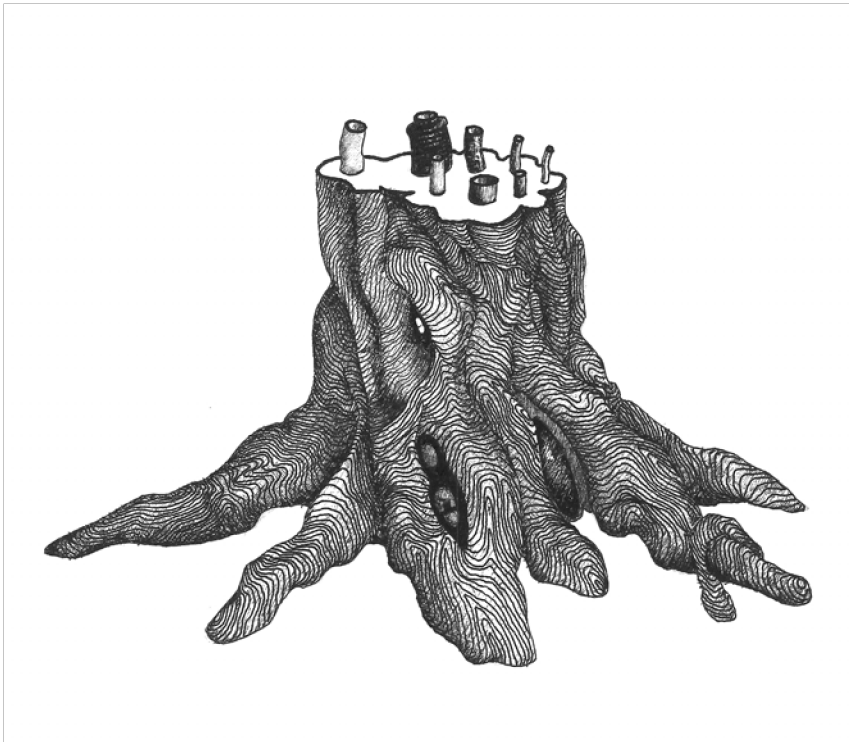

Fig 26. The pivotal strength of a trunk is proportional to the span of its branches.

Humility attracts harmony

Trees connect other species and benefit from their ecological relationships. Trees that love permanence and calm make friends with rocks, mountains, earth, water and wind. It[18] is the humility and subservience of a budding plant towards the permanence of its friends, that helps the plant grow in harmony with the power of its friends.

[18] Pronoun *it* is used to avoid distraction from the point. Trees are living beings just like humans.

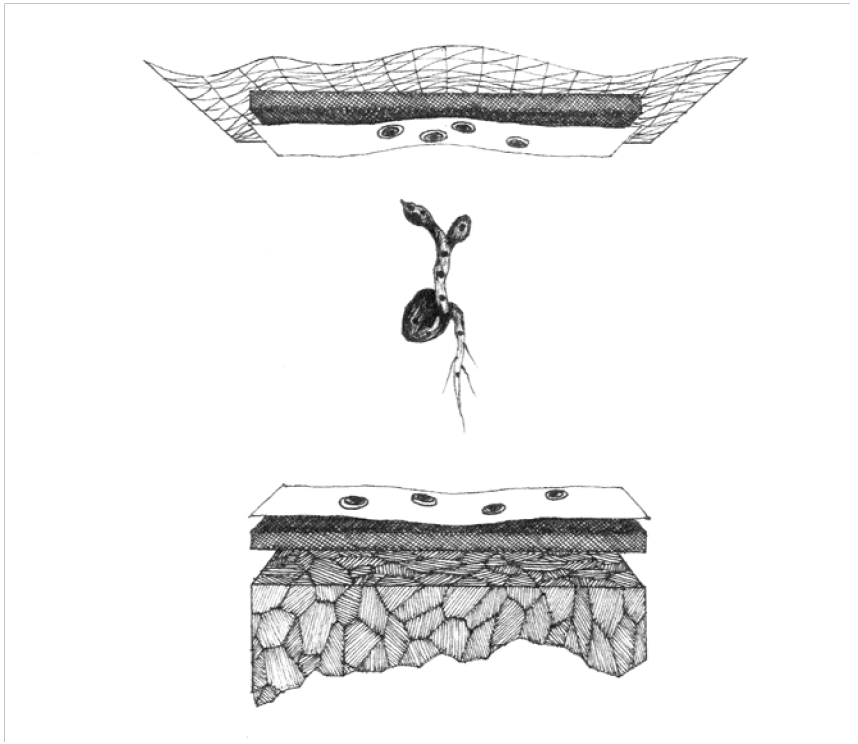

Fig 27. Budding of a plant depends on the benevolence of earth, water, wind, and sun.

A system thrives upon the sharing of its gains

Humanity is possibly the most powerful force on spaceship earth[19] but it has its inefficiencies and losses. Even when this force directs itself toward helping the deserving people, it must trickle down through endless filters of bureaucracy and other obstacles. Presently the human governance systems are designed around maximizing productivity. Trees teach us to design them around maximizing the distribution of whatever is produced. Trees have developed a method for passing on sunlight from the top of its canopy all the way down to those parts which never receive the sun directly. All parts of a tree share this goal in all stages of their development.

[19] Term first used by Sir Richard Buckminster Fuller

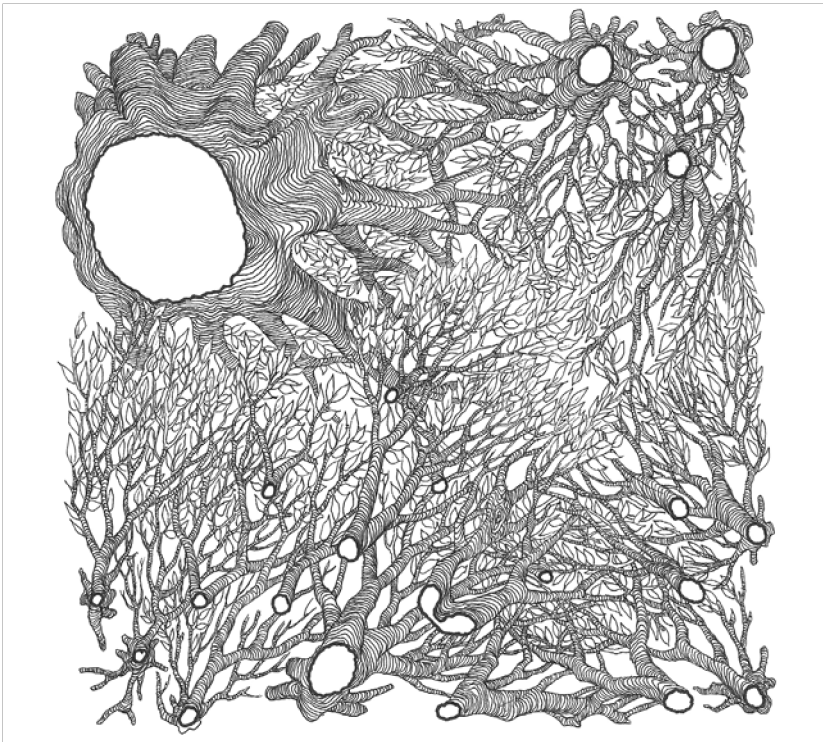

Fig 28. Leaves on the top reflect sun in a way that light reaches the leaves at the bottom.

Self-awareness of the parts increases the performance of the system

Blind following of the human beings to a given ideology has proven to be a dangerous force in human history albeit often short-lived. Leadership that seeks such following may appear to thrive temporarily but such a system never sustains itself. On the contrary, those systems which are based on the empowerment of their parts thrive lastingly. Trees have the perfect lesson for humanity in this regard. All life forms respond to threat either through flight or fight except for the trees. Trees never feel threatened by anything because they know themselves and their role in the system far too well. They even let themselves get cut and they fall without a fight. Yet they are so significant to the system that when a system loses a tree, the system as a whole reacts to this loss. A large number of natural and environmental calamities have been attributed to the cutting of the trees.

Fig 29. The source-less scream of the system is deafening when it loses a tree.

The center-of-gravity of an asymmetrical structure can be displaced through changing the tension-integrity of the system

This lesson concerns the makers of the built environment. Presently, the construction possibilities are vastly limited by the materials and the methods used by humans. Tensegrity[20] systems are still finding their way into the mainstream construction industry. Physical constructs of the trees give humanity a glimpse of the possibilities of indiscrete flow of (tensile and compressive) structural forces.

[20] Construction models based on Sir Richard Buckminster Fuller's tension-integrity

Fig 30. The TIR (tension integrity regulator) of a tree.

The stability of a system depends upon the rate of its growth

A most important factor in creating a world that works for entire humanity is the factor of time. Human beings are often either over-ambitious or under-ambitious with respect to their goals, and many a times, the loss of patience or a miscalculation of time has ended into a catastrophe for humanity at large. Syncing human ambition with the right amount of time for its fulfillment is a lesson pronounced by the trees. Trees receive continuous feedback from without (gravity, wind, weather, soil etc.) and from within (budding of branches, creation of nodes, overall strength, height and span etc.). All of this information is processed in the binding agent of time. If a tree grew any faster it would comprise the strength, any slower and it would miss the opportunity of growth. By learning from the growth and form of trees, developmental goals of humans could be refined on the account of the necessary time they need to give optimal results.

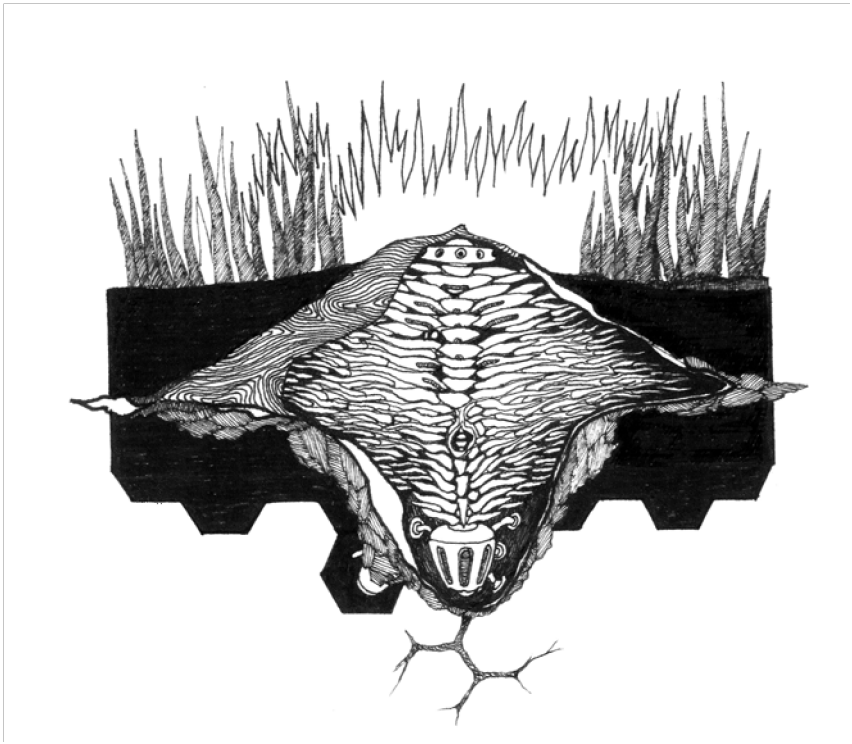

Fig 31. The Rate-of-change receptors of a budding plant.

Sun is the ultimate source of renewable energy

Trees rely on sun as their ultimate source of energy. It could be so because other forms of renewable energy like wind or wave energy depend on the temperature differential- which is created by the sun. Furthermore, the sun galvanizes the spaceship earth reliably. Instead of looking down, humanity must look up for the ultimate source of energy. Anything that requires more power than it can harness from the sun must be re-envisioned.

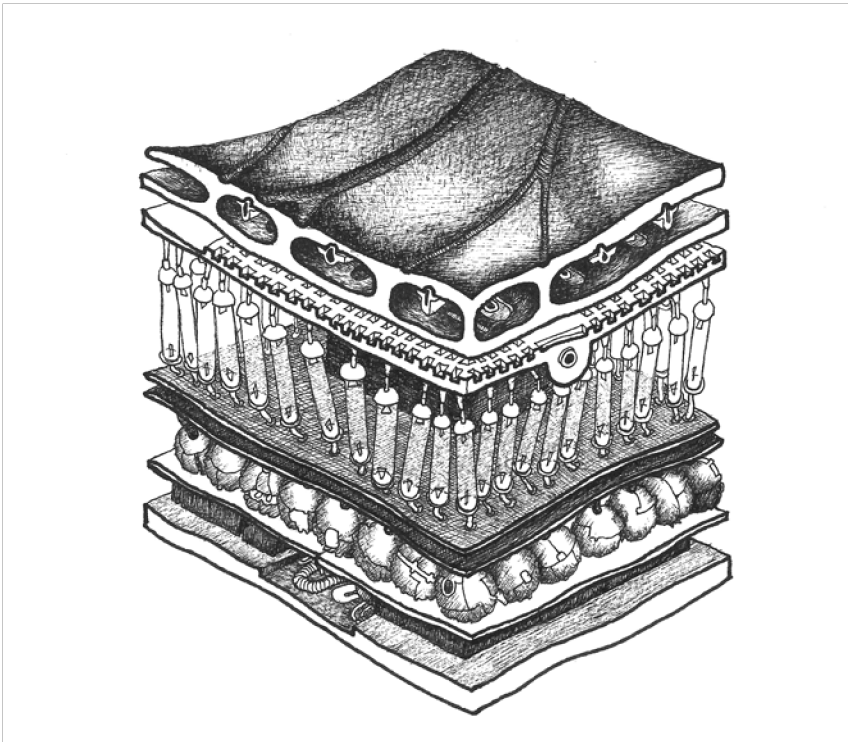

Fig 32. Solar turbines in the cross-section of a leaf.

A major source of human suffering is human greed beyond need

Human beings have developed a deplorable system of ownership of natural resources. Humans believe that they own the natural resources in their reach. But they do not own the planet as a whole. The only thing that keeps a country from spoiling its *own* natural resources is the availability of required technology to spoil them. Trees introduce a different system of utilization of the natural resources that is based on the borrowing instead of ownership. Trees borrow as little from the environment as possible and they return their loan with as much (environmental) interest as they can.

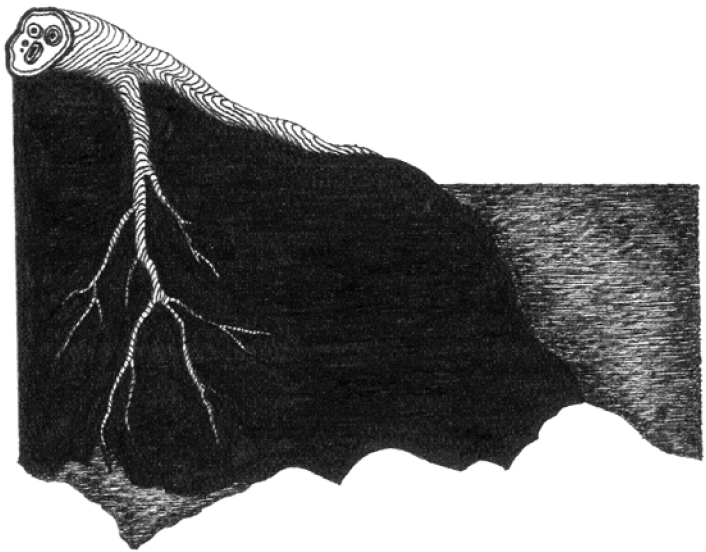

Fig 33. A root approaching the smaller reservoir of water.

Stable systems regenerate continuously

Several human systems like judiciary, corporate, and educational systems etc. are effective only half the time in a day. The physical infrastructure of these systems remains unproductive at night. Trees switch some of its functions with the rising and the setting of the sun but trees never switch themselves off completely. The technology of the trees suggests that it is possible to envision a world in which all the resources of humankind regenerate spontaneously.

Fig 34. A tree is ever awake.

The key to the optimization of space is minimum material footprint

Leonardo da Vinci mimicked the natural processes in design through mechanical means. Neri Oxman mimicked the principles of nature through the means of material (re)organization[21]. As humanity continues to familiarize itself with more complex properties of nature, new geometrical possibilities are emerging for spatial design- as discovered by Buckminster Fuller. Humanity is approaching a major crossroads in its understanding of nature- and in turn in its technological advancement. It is a junction where the mechanical, the material and the mathematical meet. The spatial construct of a tree is the key source to understanding the relationship between different approaches of biomimicry.

[21] Please see Neri Oxman's work on *Material Ecology*.

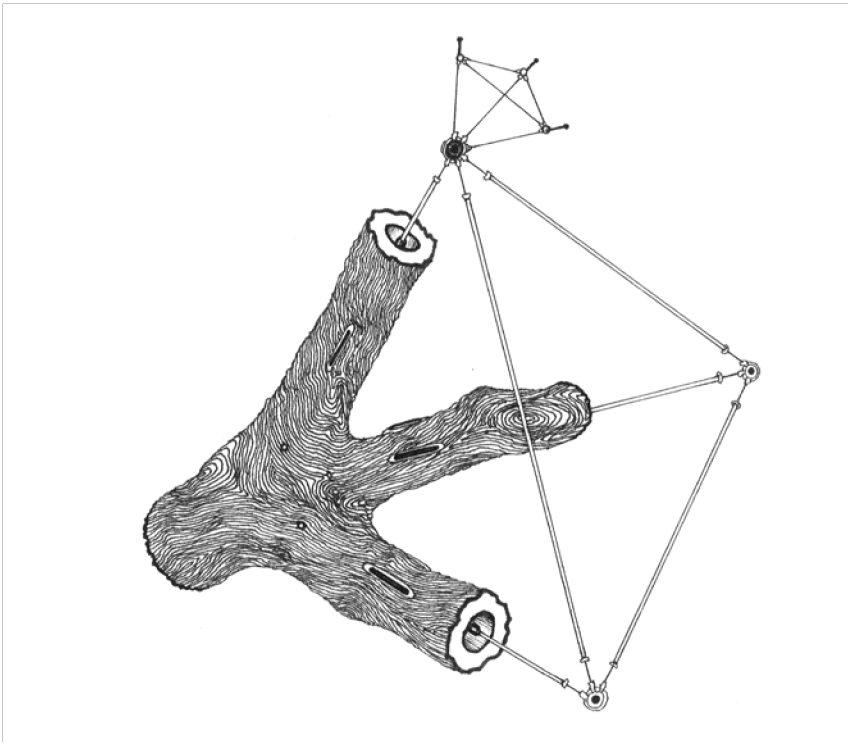

Fig 35. Spatial geometry of a tree pursues perfection.

The size of the part is irrelevant to its significance in the system

Humanity revolves around major events; global news, political leaders, and History. It is evident that all human beings have their own unique beautiful stories and all of them have the capacity to further a cause or to contribute largely to the system. Human beings have been de-institutionalizing their systems progressively but humankind as whole, is still far from replacing 'the significance of the few' with 'the significance of all'. *Treeanity*- unlike humanity- depends upon its smallest parts for life. Therefore, trees make sure that their smallest parts die last.

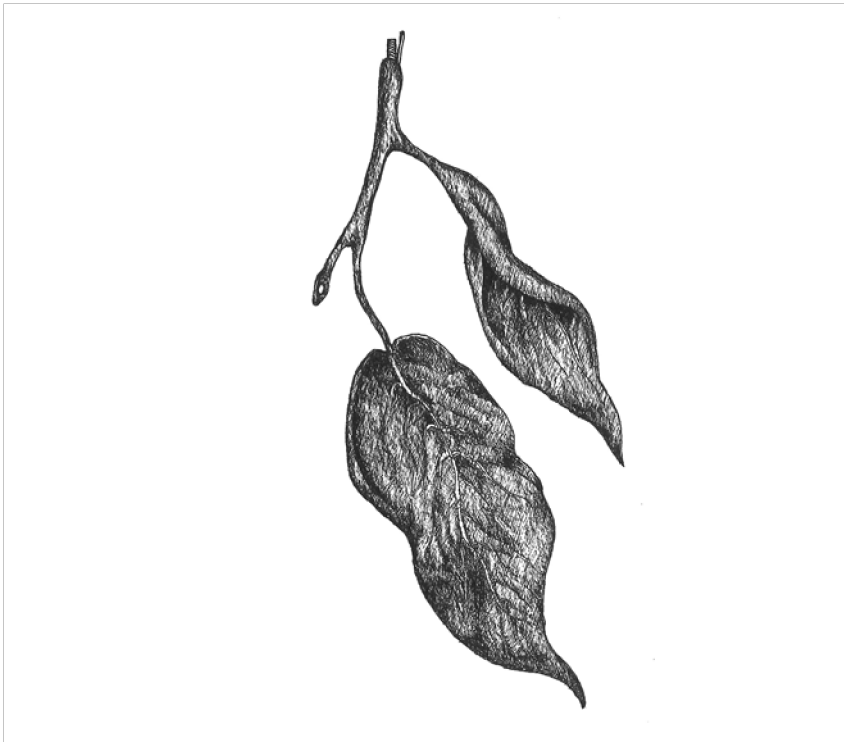

Fig 36. Dysfunctional leaves would end a tree

Seekers come to knowledge

Where there is something valuable, its seekers find a way to reach it. Educational system of humankind, particularly in the developing world, is largely based on an obsolete method of teaching and testing[22]. When extraordinary talent finds no way around formal education, they drop out, and leave it altogether in order to fulfill their dreams. Trees invite all kinds of ecologies and systems. Their ways suggest that it is possible to create a formal educational system that supports and nurtures all kinds of thoughts and descent- one which does not impart knowledge but rather creates it mutually.

[22] Fuller, *Critical Path*, 87.

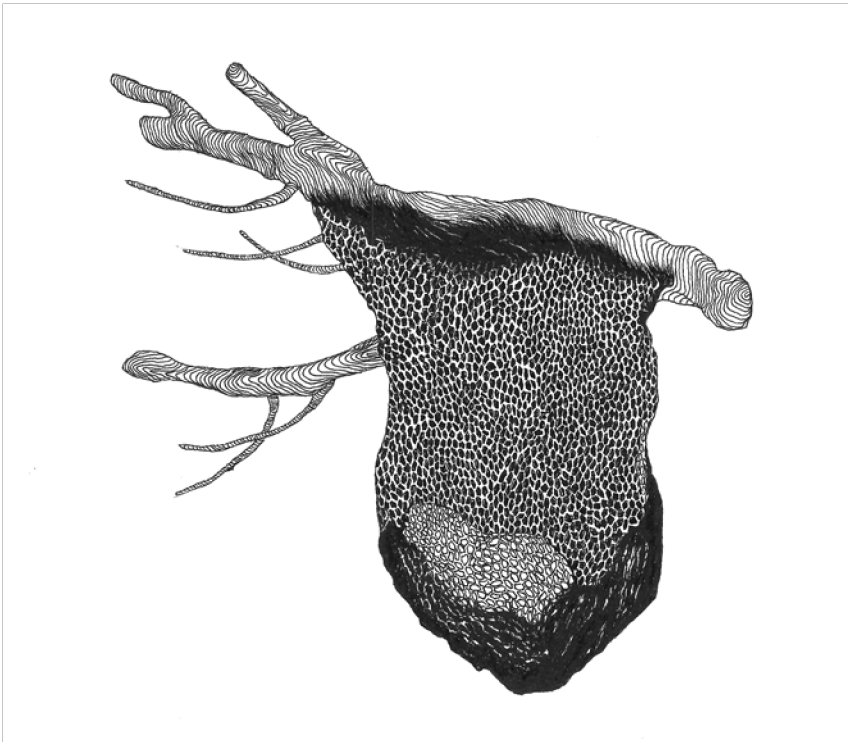

Fig 37. Beehive on a branch.

Humans connect with the trees the same way the cells connect with the fractal bronchi of a lung.

The premise that life is the synergistic outcome of natural processes, is most beautifully demonstrated by the activity of the lungs. Bronchi that fractal out into the lungs grow the same way as the branches of the trees. Body cells receive life and oxygen from lungs, and human beings and other life forms receive oxygen and life from the trees. Trees are the reminder- perhaps a proof even- that all life is connected infinitely as the fractals of an energy pattern.

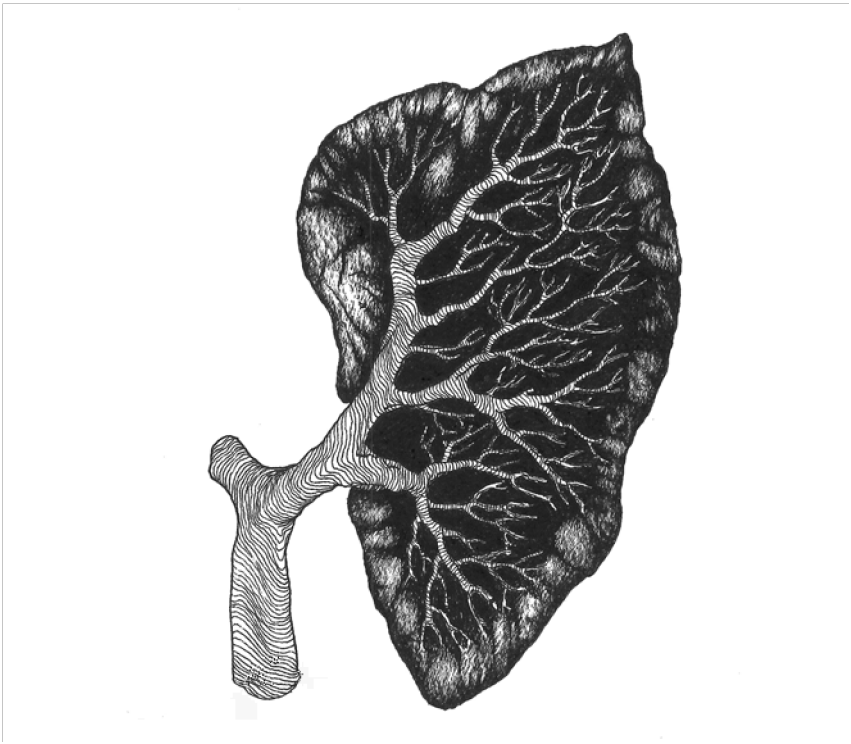

Fig 38. Fractal growth of bronchi

What benefits nature benefits all else

Humanity is finally beginning to see that what is good for environment is also good profit-wise or financially. Profit-making is humanity's natural force, and like all other forces of nature it should not be resisted. Instead, it should be used.[23] Although big companies are now producing and selling more responsibly than they were a few decades ago, humanity has not been able to simplify the deep relationship between financial and ecological systems. Trees create endless tiers of possibilities for financial interest. Emerging financial paradigms must be deeply integrated with ecological benefit.

[23] Sir Richard Buckminster Fuller's proposition for using the forces instead of resisting them

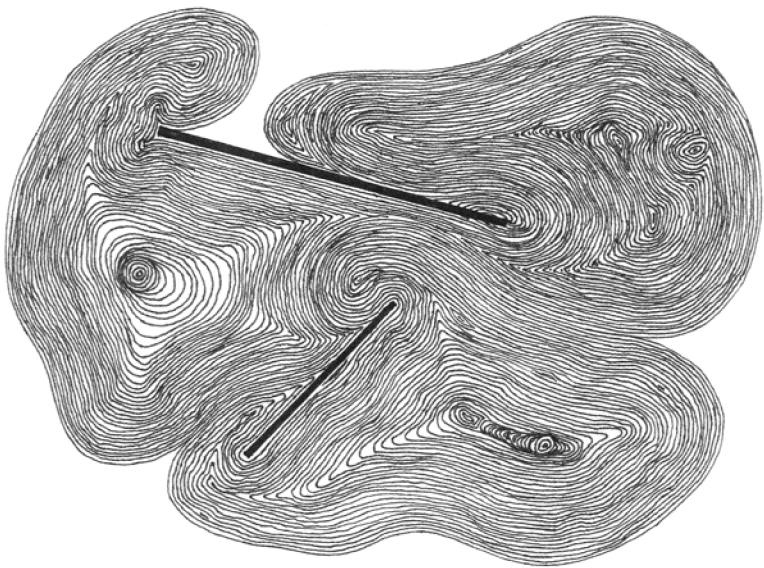

Fig 39. Profits flow continuously around the financial and ecological constraints (straight lines).

Technology must benefit more groups not less

Humanity is exploring ways of doing everything from fashion to finance more responsibly. Technology has a key role to play in this regard. Technology of the trees is based on a simple rule: it benefits as many life forms as possible with as little effort as required. Trees are a classic example of the trimtab[24] principle in action.

[24] Term used by Sir Richard Buckminster Fuller

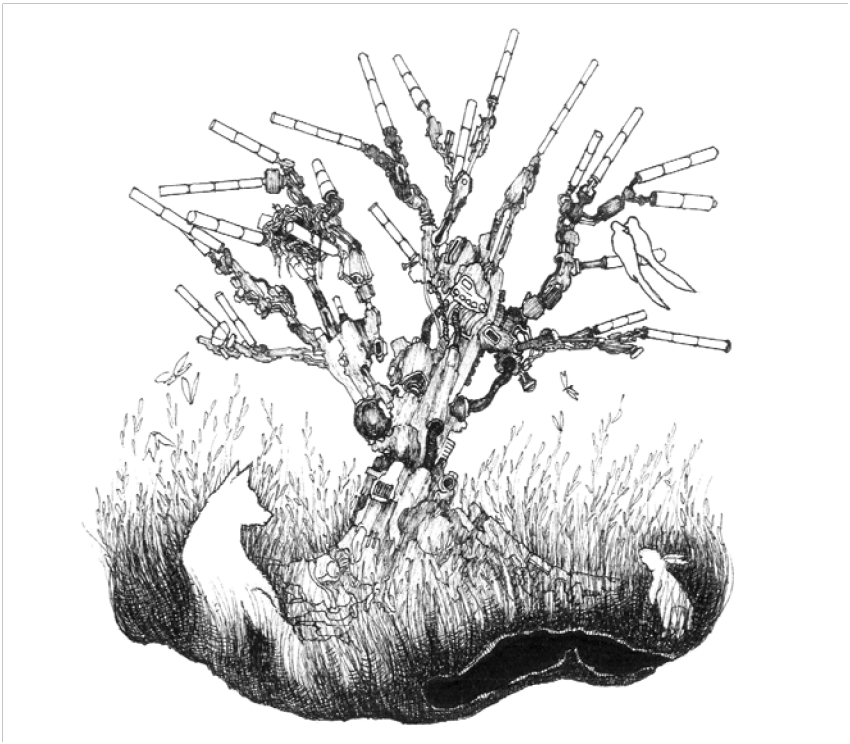

Fig 40. A tree invites multiple ecological systems.

Performance of spaceship earth improves with smaller building footprint

The surface area of the earth is finite but the atmosphere above it is infinite. Despite all advancements in construction technology, most human-made structures must taper down with height[25]. Trees on the other hand, spread out as they go up and they occupy the void. The trunk of a tree occupies minimum (two-dimensional) surface area on earth with respect to the (three-dimensional) foliage above.

[25] This architectural principle is attributed to Bangladeshi architect, Fazlur Khan (the designer of Willis Tower, Chicago, Illinois)

Fig 41. Human-made structures taper down with height while trees taper up.

Architecture is the art of controlling shadows

Architecture- on top of its function- is the art and the science of creating spatial experiences. Good architecture hinges onto its users and transports them somewhere else. Trees create spatial experiences that compete with humans' in at least two ways. Firstly, the play of light is central to the spatial experience of the trees. The shadow of a tree and the shade under a cantilever of concrete are profoundly different. The former is far more subtle on account of its diffusion of light than the later. Secondly, trees define space without inserting any dividers. Using light as a building-material in the most literal sense is no easy feat for human architects.

Fig 42. Experiencing the architecture of a tree.

All forms are governed by timeless geometrical principles

Most humans happen to believe that curves are found in nature while humans can create straight lines too. It is only a recent discovery in human history that trees are based on exceedingly complex geometry[26]. Trees- having spent most time on earth- have mastered the art of developing forms based on complex algorithms which human beings are still trying to decode. It suggests that if the 'mathematics and philosophy' of humans were plotted side-by-side with the 'mathematics and wisdom' of the trees, the former would be found in its most primal stages of evolution.

[26] Mandelbrot, *The Fractal Geometry of Nature*, 119.

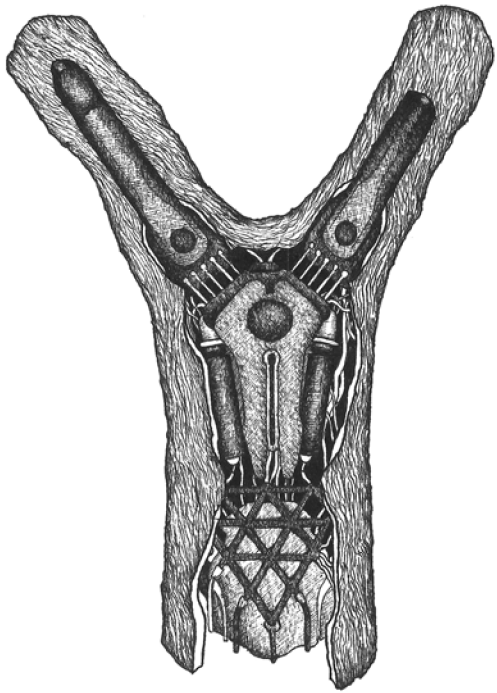

Fig 43. Cantor-set divider of a branch.

Humanity calls for a balance between courage and compliance.

The relationship between tension and compression is one of the key relationships in the harmony of the universe. Tensile and compressive forces of nature are analogous to the flexibility and the rigidity of human behavior respectively. Human beings' moments of flexibility and firmness are wavering and easily separable in time (hence the temporary alliances and wars) whereas trees demonstrate the possibility of a permanent, indiscrete, and inseparable merger of flexibility and rigidity.

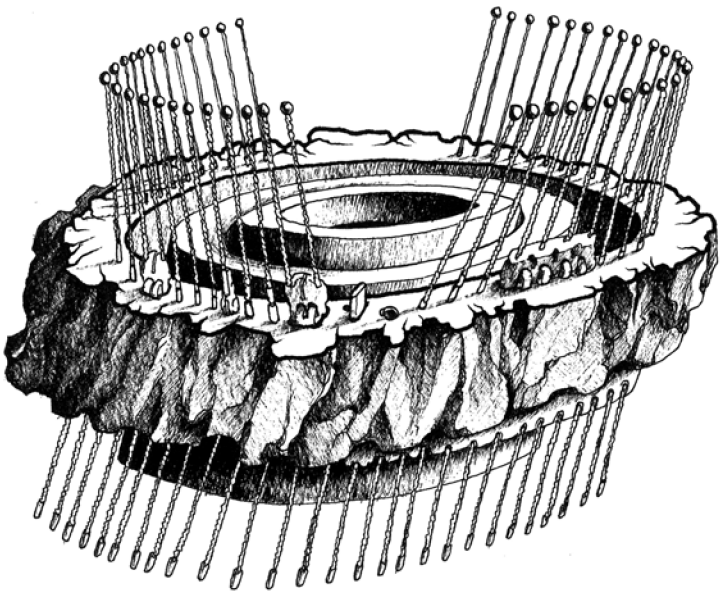

Fig 44. Reinforcement infrastructure of a tree continuously regulates the flexibility and the firmness of the tree.

Memories are rooted in the sensory experience of a body

Memories are rooted in the sensory and biological experience of a body. Trees seize soil in their roots and lock their position with respect to the stars. Trees' physical connection with place is stronger than that of humans'. Trees develop, therefore, a stronger memory of place when compared to the humans.

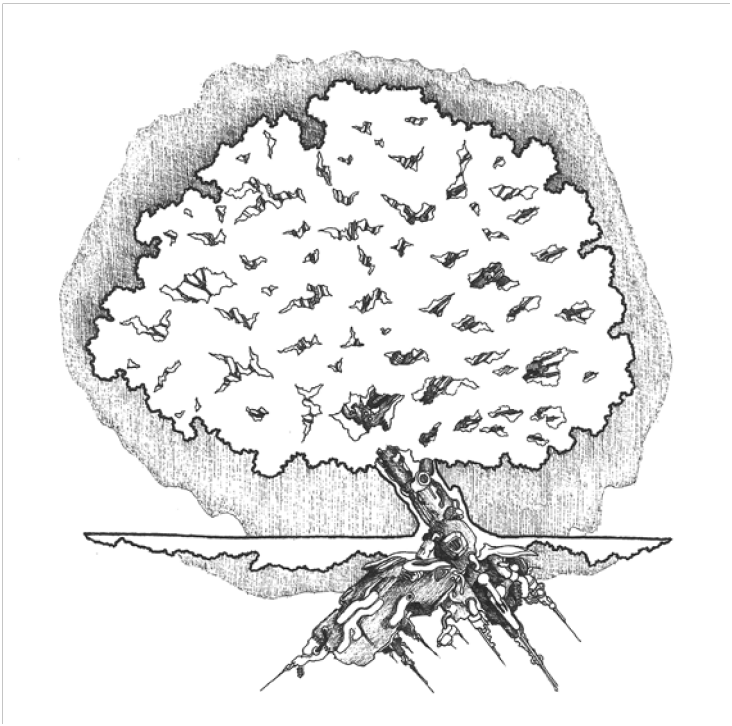

Fig 45. Trees gather memories by spending most time at one place.

Projects can be more successful when information is accessible to all

Some parts of human society have knowledge-superiority over the others. It is because the goals of human society vary vastly around the world. The quality and quantity of knowledge and of objectives change with the managerial tiers of an organization too. For humans, knowledge is power. Unlike this system, all parts of a tree share the knowledge of the goal. Without such exchange of knowledge between its parts and the whole, a tree would break under its own weight. Furthermore, knowledge flows in a continuous, non-disruptive way in the system of the trees unlike in human-made systems.

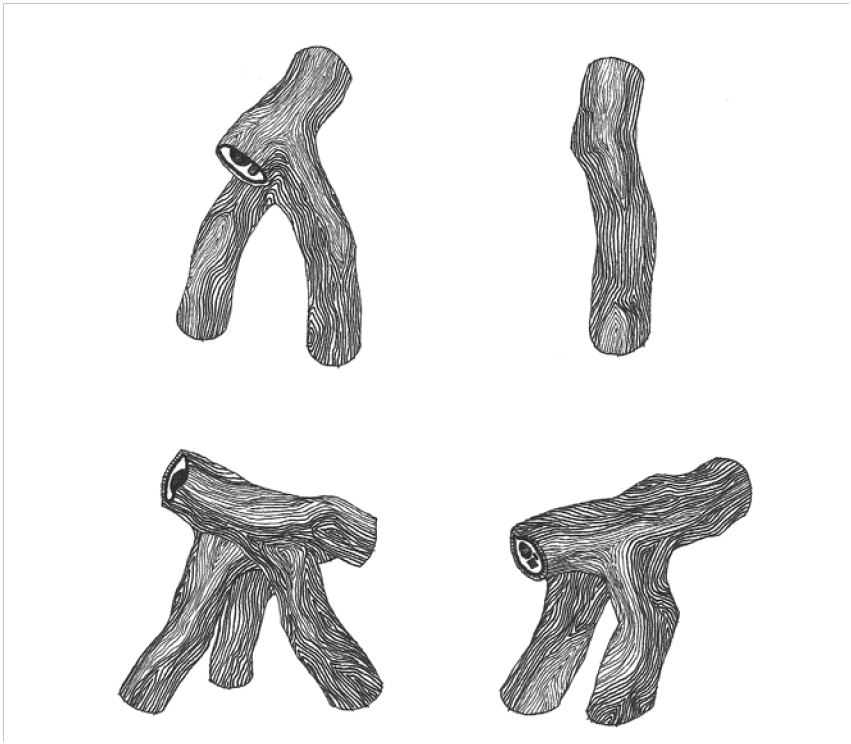

Fig 46. All nodes on branches have the knowledge of the system as whole.

Humanity must advance together. No one must be left behind.

The developmental frameworks of humankind are comprehensive and loaded with contingencies. The application of these frameworks is slow and there are innumerable biases along the process of their implementation. The developmental framework of the trees is minimal, fast and un-obstructed because it is based on the osmosis of resources. The leaves and the roots at either end of the tree direct their resources toward the opposite end. The parts with lesser concentration of these resources receive the required concentration in a uniform, fluid manner. Human developmental frameworks can be based on osmosis of resources too, and thus be made more fluid in their implementation.

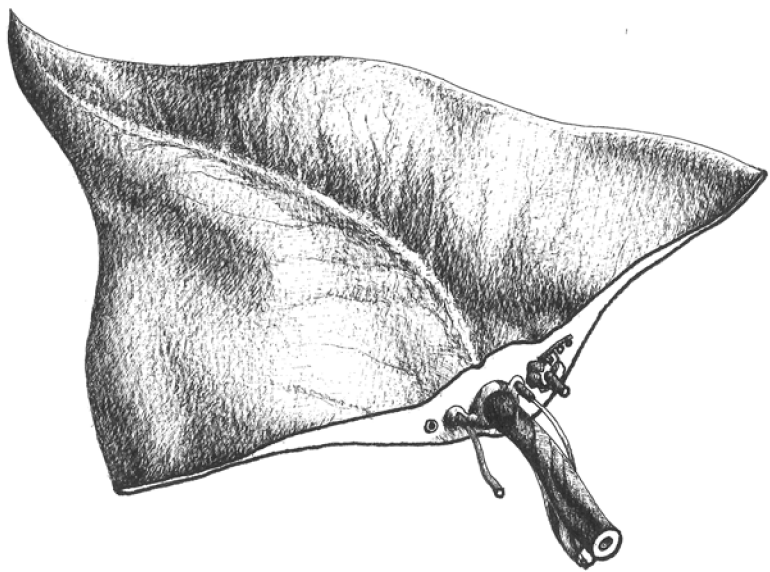

Fig 47. Ducting for the osmosis of resources.

Infrastructural-development frameworks must be scalable

Humans' theoretical models for infrastructural works are limited vastly by the scale of the required works. Architectural byelaws for instance, vary tremendously from the urban byelaws; which vary enormously from the conservational codes. It is only an example from the built environment. Human beings have designed countless systems. The way of the trees is different from the way of the humans on the account of scalability of a theoretical model. Trees use an adaptable code of change which scales up or scales down depending upon the needs of all the parts at once.

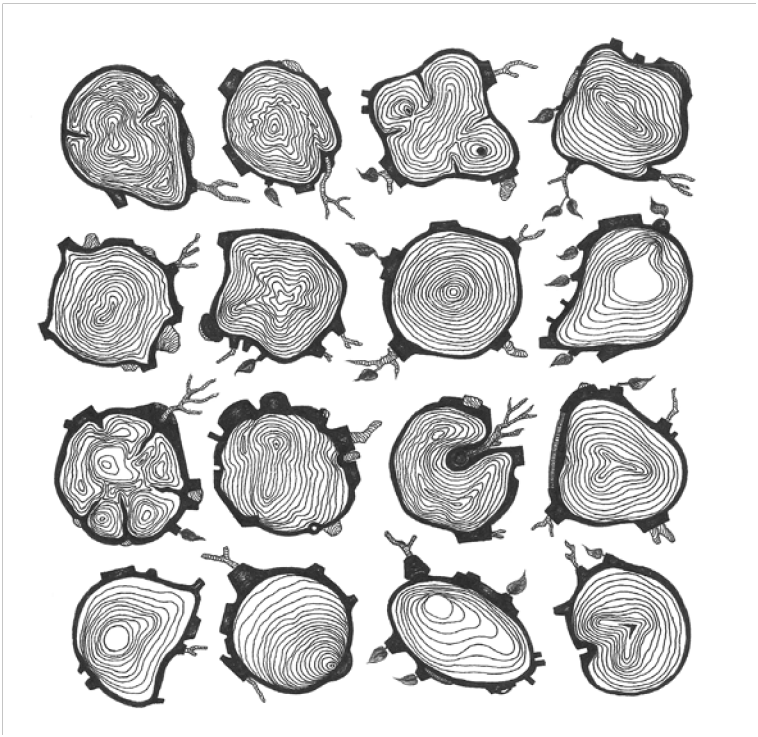

Fig 48. Trees use a scalable framework in its growth and form.

A trimtab knows the desired direction of the ship

As the complexity movement gathers global momentum, it is imperative for the individual parts of the system to know their own strengths well. It is important for the parts to hone their own forces in alignment to the goal of the larger system: a world that works for all life.

Fig 49. Tensegrity formwork keeps the tree in a bounding box.

The visible and the invisible are equally essential.

Humans develop those things first that are noticeable by other humans. Public projects championed by the politicians must be *seen* by the people. This is the way of humans. Trees are so true to their developmental goals that they make no distinction between what is visible and what is not. Trees do not differentiate between the visible and invisible side of development.

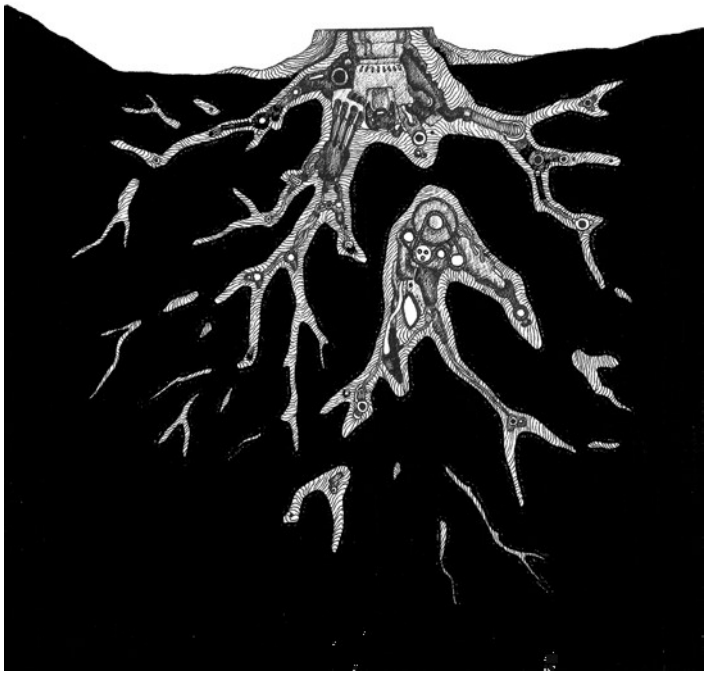

Fig 50. Roots grow with the same code of branches in zero visibility.

Bibliography

Gell-mann, Murray. *The Quark And The Jaguar: Adventures in the Simple and the Complex*: Abacus Publishers, 1995.

Fuller, Buckminster and E. J. Applewhite. *Synergetics: Explorations in the Geometry of Thinking*: Prentice Hall & IBD, 1982.

Fuller, Buckminster. *Critical Path*: Saint Martin's Griffin,U.S., 2002.
Mandelbrot, Benoit. *The Fractal Geometry of Nature*: W. H. Freeman & Co Ltd., 1982.

Johnson, Neil. *Simply Complexity: A Clear Guide to Complexity Theory*: One World Publications, 2009.

Wohlleben, Peter. *The Hidden Life of Trees: The International Bestseller – What They Feel, How They Communicate*: William Collins Pub., 2017.